American Forestry Congress
Proceedings
v.11, no.3

. XI, PP. 125-199. FEBRUARY, 1897.

PROCEEDINGS

OF THE

American Forestry Association

AT THE

Thirteenth and Fourteenth Annual Meetings,
December, 1894, and January, 1896,
at Washington,

AND AT THE SUMMER MEETINGS AT

Brooklyn, N. Y., and Springfield, Mass.

VOLUME XI.

WASHINGTON, D. C.:
1897.

GUGGENHEIMER, WEIL & CO., PRS., BALTO., MD.

UNIVERSITY OF TORONTO
FACULTY
OF
FORESTRY

SD
118
A47
v.11
no.3

NOTE.

The following interesting papers complete the publication of the proceedings of the Association to date, with the exception of a few communications which were of interest only at the time of reading. It has been necessary, in order to keep the publication within prescribed limits, to abridge some of the papers very considerably, but the editor has endeavored to preserve, as far as might be, the individuality of the author and to retain principal lines of argument as well as all statements of fact.

For convenience of reference, a subject index of the volume is included herewith.

PAPERS READ BEFORE THE

American Forestry Association

AT THE ANNUAL MEETINGS OF 1894-1895.

OBSERVATIONS ON THE DESTRUCTIVE EFFECTS OF WINDS AND THE PROTECTION AFFORDED BY WOODLANDS AND WIND-BREAKS.

By Professor F. H. KING, Madison, Wis.

We have in Wisconsin large tracts of land with soils of a light, sandy character, or sandy loam, which are now being developed for potato culture, and upon which fair yields of an excellent quality are had; but the clearing of these lands in large fields, as is now being done, has developed the fact that they are liable to serious injury from the drying and drifting action of winds.

One of these sections, at Plainfield, was visited, on May 7th, when the destructive effects in question were in progress. There had been, on the 5th and 6th, what was described as a heavy rain, but no records are kept at the place, the nearest being at Stevens Point, in the same county, twenty-one miles distant, where the rainfall on these dates was .33 and .42 inches.

The 7th was clear and cold, with a strong northwest wind, and during this and the following day, in spite of the recent rain, the fields at Plainfield and vicinity had drifted so badly that on the morning of the 8th, the loose soil, with which grain had been covered, whether with harrow, seeder or drill, had been so completely driven from many fields as to leave the kernels entirely naked, the plants lying flat upon the ground, hanging by their roots and whipping in the wind. In many other fields, where the drifting had not been so bad, the oats, which at the time stood about three inches high, were cured like hay close to the ground, and even the leaves of dock sorrel, which in places stood among the grain, were blackened and so dry as to crumble in the hand.

The drifting of soil was so bad on some exposed fields that forty, and even eighty acres of grain seeded to clover were almost completely ruined, the loose soil being removed so entirely that the marks of the bottom of the shoe-drill could be seen over entire acres of ground. But the point to which I wish to call special attention here is the fact that wherever a field lay to the leeward of any sort of wind-break, the destructive effects of the winds were either wholly avoided or they were greatly reduced. On making a careful study of the district it was found that even grass-fields and fences lying to the west and north of grain fields, had, without exception, exerted an appreciable and sometimes very marked protective influence—so much, indeed, that fields were found in the condition indicated by Figures 1, 2, 3, 4 and 5 in the chart. (Explain chart.)

Cornfields, too, drift badly at times when the corn is small or just coming up, and how full the air is of dust at these times is indicated by these two photos., both taken looking across the same field on the same day, one view being taken when there was a lull in the wind. (Show photos.)

After making these observations, the influence of the woodlands and wind-breaks in question upon the rate of evaporation to the leeward of them was studied, and in making these investigations I used a modification of the Piche evaporometer, with disks large enough to carry sheets of filter paper 5.9 inches in diameter, the water receptacles being ordinary chemical burettes graduated to tenths C. C. and having diameters

of about .4 of an inch. Six of these instruments were used, and they were hung in the open air, exposed to sun and wind, at a height of one foot from the ground. The first set of observations were made on a piece of ground planted to corn, lying to the south of a grove of Black Oak having a mean height of 12 to 15 feet. The corn was not yet up, and there was at the time a gentle breeze from a little west of north, the sun shining during the time. At first the six instruments hung at distances of 20, 40, 60, 80, 100 and 120 feet from the woods, and the following table gives the evaporation during fifty-six minutes:

Station	A,	20	feet	from	woods.....	11.0	C. C.	evaporation.
"	B,	40	"	"	"	11.1	"	"
"	C,	60	"	"	"	11.3	"	"
"	D,	80	"	"	"	11.2	"	"
"	E,	100	"	"	"	11.9	"	"
"	F,	120	"	"	"	12.9	"	"

These results show but a small difference in the rate of evaporation until 100 or 120 feet distance is reached, but at 120 feet the rate of evaporation was 17.2 per cent. greater than at 20 feet.

Three of the instruments were next set 280, 300 and 320 feet from the grove, where the amounts of evaporation in one hour were as follows:

						Evaporation.	
Station	A,	20	feet	from	woods.....	11.5	C. C.
"	B,	40	"	"	"	11.6	"
"	C,	60	"	"	"	11.9	"
						35.0	C. C.
"	D,	280	"	"	"	14.5	"
"	E,	300	"	"	"	14.2	"
"	F,	320	"	"	"	14.7	"
						48.4	C. C.

Here it will be seen there is but little variation in the amount of evaporation at the three outer stations, but the mean evaporation at these is 24 per cent. greater than at the three inner ones.

On May 31, another trial was made to the south of a Black Oak grove 80 rods square, where the trees averaged perhaps 15 to 20 feet in height. The first two instruments hung above

ground seeded last year to clover and timothy, but only timothy had come where the second instrument was placed. The remaining instruments were upon an adjoining field of oats, which at the time stood about 4 inches high. There was in progress a fair breeze from nearly due north, and the sky was clear. Here too, as before, the disks of the evaporometer hung one foot above ground. The differences in the amount of evaporation were found to be as follows:

	Evaporation.
Station A, 20 feet	11.1
" B, 100 "	14.3
" C, 200 "	15.7
" D, 300 "	18.5
" E, 400 "	18.5
" F, 500 "	18.3

Here it will be seen that there is an increase in the amount of evaporation until 300 feet is reached, but beyond and including this limit the rate became constant. At 300 feet the rate of evaporation was 17.7 per cent. greater than at 200 feet, and 66.6 per cent. greater than at 20 feet from the woods.

Trials were also made to the leeward of a very scanty hedge-row and of a clover field, these two sets of observations being made at the same time and at corresponding distances to the southward, the wind being rather strong, a little east of north and chilly. The sky became overcast just as the instruments were set up, and it sprinkled a very little at one time.

The scanty hedge-row was a strip of blue grass 16 feet wide, in which there were scattering black and bur oak from 6 to 8 feet in height, with a few attaining a height of 12 feet, but the distribution of these was so irregular that there were many open gaps of 20 to 40 feet. And the instruments were set up behind a clump of six trees spanning a length of 40 feet, there being a gap of about the same width on either side. North of this wind-break was a naked field 80 rods wide, being planted to potatoes at the time, across which the wind blew before reaching the hedge, while the evaporometers hung above a field of oats in which the grain was about 4 inches high.

The clover field lay adjacent to and west of the potato field, and bordering the oat field referred to above on the north, and had a width, across which the air passed before reaching the

instruments, of 780 feet. The two sets of observations are, therefore, comparable, and the observed results are as follows:

		Evaporation.	
		Hedgerow.	Clover.
Station A,	20 feet from margin.....	10.3	9.3
" B,	150 " " "	12.5	12.1
" C,	300 " " "	13.4	13.0

Here, again, there is a very evident influence upon the rate of evaporation exerted by both the clover field and the hedgerow, the evaporation at 300 feet away being 30.1 per cent. and 39.8 per cent. greater than at 20 feet distant from the hedgerow and from the clover respectively. So it was 7.2 per cent. and 7.4 per cent. respectively less at 150 feet than at 300 feet for the hedgerow and for the clover.

In view of the observations here presented, it appears to me that we have in hand a case in which both the reservation of forests and the planting of trees may be urged as an expedient not only for increasing the immediate crop production, but for maintaining at a smaller cost a fair degree of fertility for the soil. In our State, and in parts of Northern Michigan, we have large tracts of land which, owing to the small natural water capacity of their soils, are, when unaided, on the verge of barrenness, and yet which are capable of producing remunerative yields of potatoes and of other crops which mature with a relatively small amount of water, but I feel confident that the tendency of these soils to drift and to suffer from drouth makes it expedient, if not necessary, to hold portions of it as forest reserves, and the observations here presented lead me to feel that were these lands to be cultivated in narrow north and south fields, leaving, and even planting when necessary, belts of timber primarily to break the force of the wind and to increase the relative humidity of the air which passes across the fields, the total agricultural output might easily exceed what would be possible were the whole surface cleared and tilled, unless irrigation were resorted to. At any rate, I can but feel that here is a practical problem which those interested in the reforesting of lands may well give serious study.

Then, again, nearly the whole timber district of the northern half of our State has now been so thoroughly deforested by man, fire and winds, that the near future must witness a large

influx of agricultural population; so that if anything is to be done in the direction of forest reservations, this is the time for steps to be taken. Indeed, large land-owners already have agents in Europe negotiating the establishment of colonies within our borders, and such a colony of Finns has been so planted on the shore of Lake Superior.

WOOD-LANDS AND WATER-FLOW IN NEW JERSEY.

By C. C. VERMEULE, 71 Broadway, New York.

As consulting engineer of the Geological Survey of New Jersey, I began, in 1890, by direction of State Geologist John C. Smock, a full investigation of the water-supply resources of that State. The importance of the subject is shown by the fact that in 1894, 1,114,403 inhabitants of the State consumed an average supply of 107,840,361 gallons of water daily. My studies covered four years, and gaugings were made of several typical streams, which were compared with cotemporary rainfall measurements made by the State Weather Service. It became necessary to investigate most of the causes which affect stream-flow, and among them the influence of forests. The results of these studies are given in the Report on Water-Supply, published by the Survey in 1894. I wish to present to you here, briefly as possible, what these studies showed as to the effect of forests upon stream-flow.

In order that you may know the nature of the forests under discussion, I will say that during the progress of the topographic survey, from 1880 to 1887, a survey was made of the forested area of the State. Practically all New Jersey up-land will produce a spontaneous forest growth if left uncultivated; consequently, all up-land not cultivated or occupied by towns, was classed as forest. As we use the term, therefore, it includes all from stump and brush-land up to a good growth, 50

or 60 years old, with very little older. Although there is of late a marked tendency to acquire larger holdings, this forest is mostly held in small lots, a few of these lots being cut each year; consequently, all ages from brush up are uniformly represented. The upland area of the State being 4,494,567 acres, the surveys referred to show that, not including isolated tracts of less than ten acres, 2,069,819 acres, were in forest, or about 45 per cent. Southeast of a line drawn from Sandy Hook to Salem, this forest is nearly or all coniferous—pine on the highland and white cedar in the swamps, the latter being quite dense, but the upland timber is scattering, not usually thick enough to shade the earth. The soil is light sand and gravel.

In the northern portion of the State the forest is nearly all deciduous, oak and chestnut predominant, with hickory, beech, birch, maple, red-cedar, etc., in good proportion. This timber, being mostly held in small lots, is not extensively cut off at any given period, but the various holdings are usually cut about once in thirty to thirty-five years, this being found to be the most profitable age for chestnut. In the past there has been some cutting for fire-wood, hoop-poles and charcoal at younger age, to the injury of the growth. This practice is decreasing. The deciduous forest growth is healthy; the southern pine growth suffers much from fires. The percentage of total area in forest varies with the surface geology, being greater on the glaciated than on the unglaciated portion of the same geological formation. On the glaciated portion of the Archaean highlands, on the Kittatinny mountains, and the Tertiary pinelands of Southern New Jersey, from 80 to 100 per cent. of the whole area is forested. Kittatinny valley has less than 20 per cent., the glaciated red sandstone country 20 to 60 per cent., the unglaciated less than 20 per cent., the clay and marl country about the same. A large part of the basin of the Raritan river and most of the country drained by the branches of the Delaware below Trenton, have less than 20 per cent. of their area in forest.

There has been little change in forested areas for many years. The census shows an increase of only 330,000 acres of cultivated land since 1850. Probably for the last quarter of a century the land abandoned to grow up in forest has fully equalled in area the land newly cleared for cultivation. The economic

survey of the forests now in progress indicates that the period of maximum deforestation was about 1850.

In order to have a safer basis for conclusions as to stream-flow than would be furnished by my four years' series of stream gaugings in New Jersey, all the long series measurements of flow available for streams of New England and the Middle States were collected and studied. My conclusions, consequently, apply to these water-sheds as well as New Jersey.

The following series of measurements were thus used: Sudbury river, Massachusetts, 16 years long; Connecticut river, 8 years; Croton river, N. Y., 14 years; Passaic, N. J., 17 years; Tohickon, Neshaminy and Perkiomen creeks, Pa., each 7 years; Potomac river, 6 years. These streams have from 7 to 53 per cent. of their catchments in forest. In New Jersey, in addition to the Passaic series, I was furnished a series 8 years long on the Hackensack, and measured the flow of a dozen other streams for periods of 4 years or less. These have from 13 to 88 per cent. of their catchments forested, so that the range was wide enough for safe conclusions. A difficulty appeared, however, in the fact that the percentage of forest usually varied with the surface geology, and the latter affects stream-flow to a greater extent than forests. Taking evaporation to mean the difference between total rain-fall and total run-off of the streams, the important fact was developed by these studies that the amount of rain evaporated is never directly proportional to the total rain-fall, as is often assumed to be the case. Evaporation is increased slightly for increased rain-fall, but rapidly with increased temperature of the atmosphere. Stream-flow was found to be mainly a function of rain-fall and temperature, and little or no effect upon the total yearly run-off was traceable to forests or other vegetation, or to topography. For instance, the Sudbury catchment, with 14 per cent. of forest; the Croton, with 30 per cent., and the Passaic, with 44 per cent., all having about the same mean temperature and similar topography, show the same total flow-off for a given annual rain-fall. The vegetation on the unforested portions of these catchments is much the same in each case. We find here no effect upon evaporation, from forests. The Connecticut, with 53 per cent. of forests and temperature 2.7 degrees lower, shows much less evaporation and larger flow than the above streams, but the

Potomac, with about the same forest as the Connecticut and higher mean temperature, shows much more evaporation, the latter in each case varying with the mean temperature without regard to the amount of forest. Neshaminy creek, in Pennsylvania, having 7 per cent. of its area in forest and the remainder under a high state of cultivation, shows 10 per cent. more evaporation than the Sudbury, which can only be accounted for by temperature. The Passaic and Raritan, in New Jersey, each drain a little over 800 square miles. The Passaic has 44 per cent. in forest, the Raritan 13 per cent., or nearly the same as the Sudbury. It shows 4.3 per cent. more evaporation than either the Passaic or Sudbury. The Hackensack, like the Raritan, lies on the red sandstone plain, but has 60 per cent. of forest, nearly five times as much as the Raritan, but it shows about the same evaporation—about 4 per cent. more than the Passaic, with 44 per cent., or the Sudbury, with only 14 per cent. of forest. This is exactly accounted for by the temperature. Again, the Great Egg Harbor and Batsto, streams of Southern New Jersey, have 88 per cent. of their catchments forested with pine on upland and cedar in swamps, but this large proportion of forests and small area cultivated does not prevent an increase of 14 per cent. in evaporation over that of the Sudbury, Croton and Passaic, or of 10 per cent. over the highly-cultivated Raritan catchment. The increase of evaporation is again accounted for by increased temperature and uninfluenced by forests.

I know of no more accurate way to compare the relative evaporation from forested and deforested areas, than by measuring the rain-fall and the amount of rain flowing off, provided the observations are long enough continued and begin and end with full ground-water. In this way we obtain natural conditions, and include both direct evaporation from the soil and also the water drawn up by vegetation, much of which is exhaled into the atmosphere. The loss into the earth which does not re-appear in the natural drainage channels, may, under ordinary circumstances, be neglected. This method is certainly far preferable to the attempts to measure evaporation on a small experimental scale, which have frequently been made, and the results of which are often quoted. Some of these measurements entirely neglect the large draughts of moisture made

by the trees of the forest. All of them fail to obtain the same conditions which prevail naturally over large areas of forests. I am, consequently, forced to conclude, from my studies, that the effect of our New England and Middle States forests upon the total flow-off of streams, hence upon evaporation, is not important enough to be shown in the measurements of stream-flow.

A further analysis of observations on the Passaic catchment indicated that while the total average annual evaporation for an annual rain-fall of 45.00 inches was 22.70 inches, the portion of this taken up by vegetation alone was but 6.03 inches, or 27 per cent. of the whole, indicating at once the minor importance of vegetation. The powerful influence of the temperature of the air upon evaporation may be appreciated when we recall the well-known fact that the moisture which may be held in the air is doubled for each increase of 20 per cent. in temperature. Again, Mr. Desmond Fitzgerald made observations from 1875 to 1890, at Boston, which indicated an annual average evaporation from water surface of 39.20 inches, whereas, observations of rain-fall and stream-flow on Sudbury water-shed for the same years show an average evaporation from the earth's surface of 23.14 inches only. The air was, therefore, able to take up 16.06 inches more moisture from the water than it obtained from the land; hence, it is to be considered the powerful factor in determining evaporation. Again, in support of our conclusions, if evaporation is so much less from forested than from cultivated areas, as is sometimes claimed, should not forests be found thriving in full variety and luxuriance far beyond the limit where rain-fall becomes too light to support other vegetation?

Next we have to consider the effect of forests upon the greatest and least flow of streams: A careful investigation of recorded greatest and least flows per square mile of catchment, yields no results, indicative of any important effect due to forests. The maximum freshet usually occurs either when the ground is frozen and a warm rain comes on a heavy covering of accumulated snow, or else in summer, when an unusually heavy rain falls upon ground already saturated. The rate of flow-off is then mainly determined by the topography of the catchment. So the lowest flow occurs when the stream has for a long time been drawing upon stored ground-waters, and has

drawn down such waters to a point far below where they can be influenced by any surface conditions. The rate of flow is then affected mainly by the capacity of the earth of the catchment for holding water and its rate of yielding up the same. It is a matter not of vegetation, but of surface geology; therefore forests can have little effect upon either the greatest or the least rate of flow of a stream.

Thus far our results are negative, but very beneficial effects were nevertheless observed from a good covering of forest upon the catchment. It became evident from these studies of stream-flow that streams were often supplied for many months entirely from water stored in the ground. For seven months in 1880 and eight months in 1881, the Passaic river was thus supplied. With only rain enough to make good the evaporation our New Jersey country will yield up in nine months ground or spring water equal to from 2.29 to 7.59 inches of rainfall. Small, barren, red sandstone catchments yield the least water, and the sand and gravel of the Tertiary formation the most. If the rain falls uniformly from two to two and one-half inches per month may be taken into the ground, and discharged thence to the streams. The entire rain-fall of an average year, less the evaporation, could be thus taken into the earth, and none need flow over the surface to the stream. Anything which affects the capacity of the earth to take up water, and the rate of discharge of the same to the stream, therefore, affects the stream-flow by making it more or less uniform through the year. If the surface is forested, a mass of absorbent humus is present; the tree roots, fallen trunks and mosses all obstruct the flow of water over the surface, and hold it until the earth can take it up. The roots increase the friability and absorbent power of the earth; the water is held and absorbed in large quantities, and slowly fed out to the streams.

Cultivation also, like forests, increases the absorbent power of the earth, and well-cultivated areas will, I find, take up as much water as forested areas. Here, however, drains are provided and water courses opened to hasten drainage of the ground-water into the streams. As a result, the discharge of streams after a rain is quicker, freshets are more frequent, the dry periods longer. This is admirably illustrated in the case of the Passaic and Raritan. The former has 44 per cent. of its

catchment forested; the latter only 13 per cent., the balance being well drained and highly cultivated. Each will draw about four inches of water from the ground in nine months, but during the first three months the Raritan discharges 2.52 inches of this, the Passaic 2.10 inches, or 17 per cent. less. During the last three months, however, the Raritan discharges .70, the Passaic .87 inches, or 25 per cent. more. The Passaic, consequently, has a much more equable flow. During four years, freshets exceeding 10 cubic feet per second per square mile, occurred but five times on the Passaic, against thirteen times on the Raritan, whereas the Raritan sank below 2 cubic feet per second per square mile, an average of 271 days each year; the Passaic only 245 days. While in the case of these particular streams this result may be due partly to surface geology, the same facts were observed throughout the list of measured streams. Those having the largest proportions of forest upon the catchment invariably show the best sustained dry season flow, although the total run-off is no greater.

Our Southern New Jersey streams have the most forest, and are remarkably steady, the dry season flow averaging double that of the northern rivers. This is undoubtedly due in large part to the great absorbent power of their sandy catchments, but a critical study of their daily flow reveals the important contribution of the cedar swamps to this result. Should these be cut off the streams would suffer, becoming much more unreliable.

It will be seen that as between cultivated and forested catchments, therefore, our gaugings indicate the same total run-off for a given rain-fall, but a much more uniform discharge, fewer floods and shorter dry periods on the forested areas. Forested streams are consequently more valuable and reliable for water power, and for water-supply they require less storage reservoir capacity to provide for a given daily draught. The waters are also much less likely to become muddy or otherwise contaminated.

The worst condition of all for a catchment is barrenness. Barren earth is non-absorbent; the water fails to penetrate it and oxidize its fertilizing constituents. Heavy rains run over the surface, washing off all of the loose material, and barren conditions once inaugurated perpetuate themselves. There is

always danger of such conditions setting in when slopes or other areas unfit for cultivation are deforested. There is a special danger of it where forest fires are prevalent. The effect of barrenness upon stream-flow is to produce flashiness. We have a few small red sandstone areas in New Jersey in this condition. The streams dry up for weeks in succession, to become torrents when rain falls in considerable quantity. As compared with barrenness, cultivation is harmless to the streams. Our aim, therefore, should be to keep all unfit for cultivation clad with forest.

Such are the effects of forests on stream-flow indicated by the most accurate stream-gaugings available for New England and the Middle States. While they fail to indicate any effect upon evaporation, or upon the very highest or very lowest rate of flow, they do show what is quite as important, a more equable flow, fewer floods, and shorter periods of extreme low water upon well-forested catchments.

THE CONSERVATION OF SOIL AND WATER SUPPLY OF HILL COUNTRIES IN CULTIVATED AREAS.

By Thos. J. McKie, M. D., of Woodlawn, S. C.

The striking remark of Humboldt—"How foolish do men appear, destroying the forest cover without regard to consequences, for thereby they rob themselves of wood and water," was never more applicable than it is today in so far as concerns my own State, particularly the middle and upper counties lying in or above the granite belt. Here the surface is for the most part hilly, and the soil composed of a thin sandy loam with a substratum of rock or clay more or less nearly approaching the surface, and affording a most favorable field for the wasting influences of the heavy rains which are frequent and often destructive to both soil and crops in that otherwise favored re-

gion. It is here that may be seen the wildest display of this foolishness of men who are invited to the little less than criminal destruction of the liberal productiveness of this virgin soil which yields abundant crops with little labor and small risk, either from unfavorable season or careless culture. And but for the prodigality of nature which is so abundantly displayed in the rapid reproduction of other though less effective covering to the soil, the latter portion of Humboldt's proposition would already have been proven in many sections of this favored land.

The treatment of the surplus rain-water is perhaps deserving of quite as much attention as forestry proper, and is equally important in considering the husbandry of our water supply, itself inseparably connected with the consideration of the question of forestry.

The deforested and despoiled fields, though blotted out from any directly productive consideration, are yet the chief factors in the problem of reduced water supply and excessive overflow, with most of the dire consequences resulting therefrom, and to that extent, at least, should become an adjunct to our forestry system and receive a share of our attention.

In the cotton-belt the idea has long and generally prevailed, and has been extensively practiced, that it is a poor plantation on which enough cannot be produced to buy another with. Cut down and wear out, and cut down a second field or farm while the first is being exhausted, the forest being considered an incumbrance rather than a treasure, as it costs both time and labor to remove the timber, valueless by reason of its abundance. Such has been the effect of this destructive policy that today many sections of this highly favored country are barren of primeval forests, the place of which has been taken by broom sage, gullies or Old Field Pines, which have such firm hold that reclamation is well nigh hopeless as to most of it. To the treatmen of land of this description it is desired to call more particular attention.

Each State has its laws for the protection of the citizen, for preserving health, laws against cruelty to and maltreatment of animals and laws to protect the land and forest from his neighbor, but none that I am aware of to protect the land or forest against the owner himself, while nearly all of health, happiness and prosperity depend largely upon this protection. Govern-

ment ownership is not, perhaps, the best way of accomplishing this, neither can unrestrained license, even with his own, protect a man against himself. When he begins to use, or rather abuse, his liberty in a way detrimental to posterity, the time has arrived for the interference of law. A system or rewards and penalties might be enacted by the Legislature of each State by which this wise purpose could be accomplished. For the best protected farm in each county of any given State a premium might be offered proportionate to the value of the farm itself. For neglect of this protection a penalty should attach for injury done either to the public or individual by such neglect. Taxes on forests might be remitted as a further inducement to their preservation. While it is the pabulum furnished by nature to both vegetable and animal kingdoms, water is also the great destroyer which takes away much of the wealth of the world. With proper attention from States and individuals, the evils arising from floods and freshets may be controlled or greatly mitigated.

The washing of hillsides, the overflow of bottoms, begin with the first accumulation of water at the tops of the hills, and here is the place to begin to correct or check the evil which is in proportion to the accumulation. To accomplish this, two things are necessary: The one is by horizontal culture to diffuse the water as much as possible, cause it to spread out, and cover as much surface as may be, and thus weaken its force at any given point and cause the excess to pass through rather than over the soil. The second is not unlike the first—retard the surface flow by a thorough system of terraces, which, when properly arranged, give on each hillside a succession of levels from top to bottom, effectually preventing excessive accumulations of water at the bottom. By stretching a line between any two points at top and bottom of any given declivity, and then drawing a succession of angles along the same line, like a staircase, you have an apt illustration of the idea intended to be conveyed. The advantages gained by this method will at once become apparent: The soil is saved by reduction of gravity, the arrest of the downward sweep of water and soil, and the increased time in descent allowed in the delay for a deposit of surface soil while being carried downward towards the valleys and streams below. It is not difficult to understand how this

retardation may be thus accomplished, or to conceive of its advantages when extensively applied. Delays, therefore, are not always dangerous, but in this case highly salutary. Having opposed these obstacles to the flow of surface water, and at the same time having well provided against accumulations, both at the top of the hill and along the entire declivity, we are better prepared to deal with the excess or overflow which must eventually reach the bottom. Here, as the question appears to me, other and yet graver errors have been committed in the management of farms, and still more in the diminution of the evils of floods and freshets. It is believed to be ruinous, as it is unwise, to even attempt to confine these overflows within the limits of an ordinary ditch or embankment. Experience has fully established the fact that sooner or later water will find its way through or over these at some point or other, and all who have ever visited a hill country can bear testimony to the ravages which have resulted. To remedy this evil, old ideas must be abandoned. It is not to be understood that drainage and ditching is to be ignored or dispensed with; on the contrary, both should be practiced more extensively in order to carry out more fully the leading idea of diffusion and delays. Ditches through low land, creek and branch bottoms, are a necessity for drainage and successful cultivation. In cutting a ditch the mistake of piling earth to increase its carrying capacity should be avoided. Like water, it must be spread out over the surface of contiguous land. Overflow, then, must be accepted as a necessity, and should be utilized as a benefaction to the soil they cover as a conveyor of fertilizers derived from water and silt. The wise farmer will use every legitimate means to retard the current of overflows through his premises. The means by which this may be accomplished after the excess has reached the bottom, as it appears to one who has given time and thought to its study and practice, may be made more apparent by picturing to the mind a piece of bottom land through the lowest part of which there runs a central ditch by which the ordinary flow of water is conveyed, this being without side elevation or embankment reaching above the common level of the contiguous land, field or pasture, as the case may be. Running into this from both sides and at suitable distances, which should be regulated by the prevailing fall of the main ditch, and

extending back to a terrace at the foot of the adjoining hill, cross ditches giving fall enough to avoid stagnation are made, with the earth taken from the ditch evenly distributed on its lower side and raised high enough to prevent overflow. By this arrangement it will be perceived that the entire bottom is for the time being given up to the occupancy of the body of water which diffuses itself evenly over the surface of the soil between these cross sections and embankments, giving time to throw down a portion of its rich sedimentary deposits, and so delayed in its downward course as to reduce the damage of overflow to a minimum while enriching the soil at the same time. Timbers may be made to take the place of these cross ditches when convenient or plentiful. In preventing or staying the waste of cultivated land the necessity of clearing new fields is to that extent obviated, and to an equal extent the forest is spared. The unsightly aspect of galls and gullies is remedied, the cultivation of the soil is made easier, it wears longer and produces more abundantly, thus making a step towards intensiveness. It also utilizes the waste of the hills to build up the valleys. Still another and scarcely less important consideration is not to be lost sight of in dealing with hill farms and forests. If every farmer living on the water-shed of a given river will go earnestly and industriously to work to constitute himself a true husbandman in saving his own possessions, in getting the very most of every shower of rain in the way this paper indicates, we will hear less of the ravages of freshets and less of the evils of drouth. He will at the same time place the strongest possible barrier between the occupants and industries of river borders and the dangers of freshets. No one will fail to see the benefits which must arise from such a system or doubt the means when applied as preventives for cures of the many evils which now threaten the prosperity if not the life of our common country.

THE ADIRONDACK FOREST.

By Mr. Verplank Colvin, Albany, N. Y.

It is nearly twelve years since, by request of the then Governor of this State, I addressed the first American Forestry Congress, at the first meeting in Cincinnati. At that time the presence of Governor Cornell and Ex-Governor Seymour (both earnestly interested in forestry) had been hoped for, but the official duties of the one and the delicate health of the other prevented their attendance. Many of the practical questions of governmental forestry were then matters of doubt, if not of dispute.

Even the propriety or feasibility of State care of forests was questioned by some public men; but the demand of the people for forest preservation has enforced the trial of administrative plans. The legislation establishing the Adirondack Reserve is so recent and accessible in the statutes that it need not be recited. Your request that I should address you means that you wish me to communicate some of my personal observation and knowledge relative to the great Adirondack forest acquired during the quarter of a century that I have devoted to the surveys in this region.

Shall I tell you of these forests as they were? As they are? As they should be?

As they were when I began the exploration of the remote portions of the wilderness at the close of the civil war—I cannot think of them without regret for their then grandeur and beauty. At the close of the civil war the Adirondack region was a wonderful forest—a cathedral of trees. A great portion of the forest was then practically unknown. Its thousand lakes were supposed to number only one or two hundred. Whole valleys and mountain ranges of primeval forest existed—yes, valley after valley, and range after range—which had never echoed to the sound of a lumberman's axe. The moose was not yet extinct. The wild trumpeter swan sunned his snowy plumage on the shallows of the northern rivers. The wild pigeons, in flocks that darkened the sky, made here their nesting ground, breaking the limbs from the trees by the weight of their tumult-

uous masses. Eagles, hawks and owls fattened on rich food. Partridges or ruffled grouse and the black or Canada grouse, and other rare and beautiful birds, were here. The beaver cut down trees and built log dams and houses of brush and mud. Wolves, bear and panther were frequently met with, the wolves, indeed, so audacious and dangerous as to venture out into the settlements, killing sheep and howling near the cabins of frontiersmen. The true source of the Hudson river was unknown, and other Adirondack rivers were indicated upon maps by dotted lines, representing a "supposed course" of the stream. So wild, so magnificent, so untouched and unknown was the interior of this great forest as late as 1865.

Forests of majestic pines yet grew upon the banks of the Upper Hudson. The pine was yet the chief sought timber of the lumbermen. Magnificent trees, towering above all the forest, stood masters among the dark spruce and Hemlock forests, which, below, were embowered in unbroken masses of hardwood or deciduous timber. The lake shores for miles were symmetrically margined with perfectly-formed forests of Arbor Vitate (the "white cedar" of hunters and guides). The great Sphagnum swamps were decorated with dark-green Balsam trees, surprisingly uniform in shape, as though trimmed by artifice of man to the form of spires of innumerable chapels. Except near settlements, forest fires had left hardly a scar on the sides of the richly-timbered mountains. There were no railroads in the Adirondacks in those days, nor on either side of it. Even the shores of Lake Champlain and the valley of Black river had yet to hear the roar of the railway train. Stages, as open wagons were called, went to some settlements on the borders of the forest once or twice a week. These "stages" traveled night and day on a journey over fearful roads, and the wearied traveler felt happy that only one day in the week was stage day. Corduroy roads, rudely made of logs, rarely having any covering of earth, were the causeways through the swamps, and over the hills the wheels struggled with huge boulders for the right of way. Each stage driver had his axe, for trees, fallen across the road, had frequently to be cut away.

I remember, in 1870, traversing the new road from North river to Indian lake, then recently opened. It was October. On either side was a dense forest of trees of enormous size.

Between these was only the single track of the new road, so deeply sunken into the soft "wooden soil" as to reach the hubs of the vehicles. At 2000 feet above the sea the pines had mostly given place to the Black Spruce and Balsam, decorating a leafless forest of gigantic Yellow Birches and huge Beech trees. The mightiest Hemlock trees were dwarfed by comparison with the great uplifted columns of the spruces, and the rough, scaly trunks of those Yellow Birches supported topmost branches which fairly swept the clouds.

Six years later I passed that way again. Only by the topography could one recognize the country. The great trees were chiefly gone. Forest fires had followed the axe, and tall, blackened columns—the lofty and horrible head-boards of the dead forest—were the chief reminder of what had been. Bad management, or lack of management, had permitted this section of the great forest to be destroyed, for the giant hardwood trees had not been cut or lumbered. They had been wasted by fire because there was no one to save them or prevent it. It is not known how these fires originated. It is more likely from hunters' camp-fire than from a lumberman's carelessness. However it happened, they are gone! There was no forest management.

Ten years more pass away. The dead and blackened trunks of the old forest have mostly fallen or are more solitary, and have grown gray with many winters of exposure to the storms. But the area of burnt forest has increased vastly. How or why no one can explain or understand. Hundreds of square miles are now bare of forest, showing the rough, grizzly ledges of native rock. At midsummer, here and there, columns of smoke are seen to rise one mile, three miles, ten miles away—a dozen of them—where there is still forest, and you are told "some hunter has made a smudge," or "probably someone with a shotgun and wadding of paper" has unconsciously fired the forest.

Such is the Adirondack forest as it was and as it is in the lowlands and accessible portions—chiefly lumbered over now, and the remnants in many places burnt away. Yet in the interior and mountain districts there remain vast sections still untouched by lumbermen and undevastated.

It was in a remote interior valley, where the symmetry and beauty of the forest was most remarkable, a region free from underbrush, with beautiful, open, sunshiny glades, naturally planted with clusters of small but well formed evergreens, where crystaline trout streams led through dark forests or wild meadows to beautiful lakes, that I first (thirty years ago) thought of the Adirondack park and forest reserve. Since then I have urged it, written of it, spoken for it, and today it is a reality.

In my report to the Legislature on the Adirondack Survey in 1873, I especially urged the acquisition by the State of those forests at the sources of the Hudson, which include the high Alpine district of our mountains.

This portion of the Adirondack forest is unique. The spruce, the balsam, the birch, which grow in such dense forests upon these Alpine slopes, had they memories, could tell of days when George the Third was King; when Washington was unknown; perhaps of times before either Indian or white man had climbed these peaks. Yet these trees are scarce three or five feet high, but aged and gray—the patriarchs of the forest—spreading out their interlaced boughs, matted together in impenetrable chaparal, where the explorer must walk upon the tree-tops if he climb at all. Higher the air is thin, and cold and piercing. A mile above sea level the forest trees have shrunk to shrubs. Arctic willows, Lapland lichens and Greenland mosses and small boreal plants are the only evidences of plant life that remain.

But in the deep valleys, half a mile below, where the white billows of the clouds go floating, are forests where, if the trees are small, they are, nevertheless, densely set, twenty-five feet in height, but scarce a foot apart, so close at times that a dog can scarce make his way among them, while the ground is one mass of humus soil, soaking with rain and the moisture of the clouds, frequently knee-deep with bright green sphagnum—a peat moss so soaked and saturated with water as to justify the name of hanging-lakes to these mosses on the mountain sides.

This is the Alpine and Sub-Alpine forest, the preservation of which I so strongly recommended in my report of 1873 and since.

This section of the forest has not greatly changed. The lumbermen have penetrated into the upland valleys, but have not reached any of the high peaks. Only the large timber has as yet been taken. In 1873, between the Schroon and Raquette rivers, North Elba and the Boreas or Old Carthage road, there was nearly 500 square miles of primeval forest. There still remain nearly 100 square miles of these Adirondack Alps unharmed by the fire or by the axe. This, with the Whiteface mountain district, preserved by a private club or association, covers nearly all the Alpine forest of New York, but this Mount Marcy district has chief value as containing the sources of the Hudson.

There should be no delay now in the preservation of this rare forest and its springs of living waters.

Of the forests of the lake region, it may be said that of those located above 1500 to 1700 feet above the sea, the choicest portions are now either in the hands of the private parks or clubs, or of the State. This is the chief region of timber and game. At Raquette lake, at points on the headwaters of Moose river, are sections of forest which no lumberman has yet cut—as wild in places as when Columbus discovered America.

In the discussions which led to the establishment of our forest preserves one of the chief arguments used was the ultimate value to the State of the timber upon these lands as a reserve for forest administration. The general agreement of high authority and experience appears to be in favor of the utilization of the already lumbered districts of the forest, so far, at least, as to meet the expense of their maintenance, if not of their cost. Yet those tracts of wild and picturesque forest, including the larger lakes, like the Raquette, the Saranac or the Au Sable, especially those sections which have never been lumbered, can be preserved intact as a memorial and evidence of the ancient forests, and the application of the European system may be confined to those natural lumbering districts in the border of the forest which have already been cut over, but have now a new growth of merchantable timber upon them. The taxes of this State may perhaps ultimately be lightened to the extent of $2,500,000 per annum from the present deforested border lands of this region, now nearly bare of timber.

Let the forests be restored on the burnt and barren districts of the Adirondacks and scientific lumbering be confined to these border tracts which have been cut over again and again, which appear to be natural lumbering districts. Let the primeval, untouched forests of the remote interior and Alpine district ever remain inviolable, and New York will possess a forest magnificent in its ancient grandeur, practically useful—the safe health resort of thousands yet to come.

THE FORESTRY LEGISLATION OF NEW HAMPSHIRE.

By Prof. James F. Colby, Hanover, N. H.

Legislation for the protection of the forests of New Hampshire is recent in origin, tentative in character, and small in volume. The reasons for this are found in the economic history of the State. When white men began their settlements within its present borders, New Hampshire was covered with a dense forest of finest timber. Apparently the only unforested areas were a few sedgy swamps, a few Indian corn fields, and the higher elevations of the White mountains. The white men came, not to remain hunters and fishers, but to subdue this wilderness and to establish an agricultural and industrial commonwealth. Trees were no less an obstacle to this end than granite boulders. The first step, therefore, to the economic advancement of the successive bands of settlers who pushed their way from Dover, Portsmouth and Exeter into the central and western portions of the State toward the middle of the last century, and finally to its northernmost border, soon after the close of the Revolution, was the felling of forests to make room for farms. So gradually was this done, that it was not until the close of the rebellion, during which the State sold for a mite the last of its public domain, that any apprehension appears to have been felt lest too much of the forest of the State might be re-

moved, and the proper economic proportion between its tillage land, its pasture and its forests be disturbed. Slowly this apprehension has spread, and with it has come a demand for forestry legislation. The large dependence of the growing manufacturing interests of the State upon the supply of water power and the Report of the Commissioners on the Preliminary Examination of the Water Power of New Hampshire, published in 1870, emphasized this demand, though it was not until 1881 that the State instituted an official inquiry into its forest resources. So far, all its legislation upon this subject has been simple and experimental, though during the past fourteen years the State has instituted three commissions to make investigations into its forestry conditions, which may give the material upon which to base a more elaborate and definite code of forestry law.

The legislation which has thus far been adopted is limited to the following subjects:

Protection Against Forest Fires.

The more general provisions relating to this subject are found in the Public Statutes, 1891, and are as follows:

"Towns may make such by-laws respecting the kindling, guarding and safe-keeping of fires, and for removing all combustible materials from any building or place, as the safety of the property in such town may require; and may appoint in such manner as may be be prescribed in such regulations, all such officers as may be necessary to carry such regulations into effect, and affix penalties not exceeding ten dollars for any offense, to be recovered in such manner and to such use as the town may direct." (General Laws, chap. 47, sec. 8.)

"If any person shall willfully and maliciously burn any stack of corn, hay, grain, or flax, or any fence, or pile of boards, lumber or wood, or any trees or underwood of another, he shall be imprisoned three years, or fined not exceeding one thousand dollars and imprisoned not exceeding one year." (Chap. 277, sec. 3.)

"If any person, with intent to injure another, kindles, or causes to be kindled, a fire on his own or another's land, and thereby the property of any other person is injured or destroyed, he shall be fined not exceeding $2,000, or imprisoned not exceeding three years." (Chap. 277, sec. 6.)

"If any person shall kindle a fire by the use of firearms, or by any other means, on land not his own, he shall be fined not exceeding ten dollars; and if such fire spreads and does any damage to the property of others, he shall be fined not exceeding one thousand dollars." (Chap. 277, sec. 4.)

"If any person, for a lawful purpose, shall kindle a fire upon his own land, or upon the land which he occupies, or upon which he is laboring, at an unsuitable time, or in a careless and imprudent manner, and shall thereby injure or destroy the property of others, he shall be fined not exceeding one thousand dollars." (Chap. 277, sec. 5.)

"Whoever shall inform the prosecuting officers of the state of evidence which secures the conviction of any person who willfully, maliciously, or through criminal carelessness has caused any damage by fire in any forest, woodlot, pasture or field, shall receive from the State a reward of one hundred dollars. The State treasurer shall pay the same to the informer upon presentation of a certificate of the attorney-general or solicitor that he is entitled thereto." (Chap. 277, sec. 7.)

"The proprietors of every railroad shall be liable for all damages which shall accrue to any person or property by fire or steam from any locomotive or other engine on such road." (General Laws, chap. 160, sec. 29.)

The court has held that this law makes the liability of railroads absolute like that of insurers, and that the concurring fault or carelessness of the plaintiff, in leaving combustible litter scattered about his premises, or in leaving his property in an exposed situation, furnishes no excuse or defense in case of such burning.

To the above statute provisions may be added the common-law doctrine, that anyone who, by carelessly kindling or negligently tending and guarding a fire upon his own land, causes injury to the property of another, by the escape of such fire, is liable in damages to the extent of the loss inflicted.

The comment of the Commission of 1885 upon these statutes now requires little amendment, and may here be abridged. (See Report of Foresty Commission for 1885, pp. 95-96.)

That Commission expressed its doubt, in which their successors will concur, whether the statutes above quoted have had any appreciable effect in curtailing the number or destructiveness of forest fires since they have been in force. The first of these statutes, though capable of wider application, always seems to have been regarded as intended only for the protection of buildings and property in the compact parts of towns. Instances are few, if any, in which it has been applied to the protection of woodland or forest. Even if so applied, this statute must prove inadequate because it allows local option, and forest fires require uniformly rigid treatment.

No conviction under any one of the four sections quoted from Chapter 277 of the Public Statutes has come to our knowledge. It was the unofficial opinion of a distinguished Justice of the Supreme Court of New Hampshire, lately deceased, Hon. William S. Ladd, that this was due to the popular judgment that the offense involved no atrocity, to the difficulty of its detection, and to the lack of adequate reward for the performance of such service.

The above statute relating to railroads is deemed by competent judges to have stimulated these corporations to take due care against causing or spreading forest fires. The common-law liability above described has been effective in restraining persons of pecuniary liability in the use of fire upon their own premises. Suits by injured parties to recover the damage thus caused are of frequent occurrence, and are often successful. (See Report of Forestry Commission, 1885, pp. 95-97.)

Despite these provisions of law, statutory and common, both the first and second Forestry Commissions recommended the adoption of more stringent laws for protection against forest fires. In 1893 the Legislature first acted upon these recommendations, and (An Act for the Establishment of a Forestry Commission) enacted the following:

"Section 3. The selectmen of towns in this State are hereby constituted fire wardens of their several towns, whose duty it shall be to watch the forests, and, whenever a fire is observed therein, to immediately summon such assistance as they may deem necessary, go at once to the scene of it, and, if possible, extinguish it. In regions where no town organizations exist the county commissioners are empowered to appoint such fire wardens. Fire wardens and such persons as they may employ shall be paid for their services by the town in which such fires occur, and, in the absence of town organizations, by the county."

Two years' experience has convinced the present Forestry Commission that this law must prove ineffective. That Commission, in its report for 1895, pp. 35-36, says:

"There is little fault to be found with the manner in which the selectmen of towns have discharged their duties as fire wardens, and that part of the law which clothes those officials with the power to protect the forests of their towns against fire, appears to require only slight modification. That part of the law, however, which relates to the protection of the great forested areas, which are found in the unincorporated townships of the northern counties of the State, should, in the opinion of this board, be amended. The provision by which county

commissioners were empowered to appoint fire wardens for places where no town organizations exist has been wholly inoperative, and, despite the frequently renewed and often vigorous and personal protests of this board, not a single fire warden for such places has been appointed under the provisions of that act.

"Thus what appears to us to have been the plain intent of the framers of that act has been nullified by the neglect of the county commissioners to give effect to its only administrative feature. The only excuse given for this neglect, so far as we know, is that the cost of protecting these areas of forest ought not to be borne by the county, but that it is the duty of each man to protect his own forest."

To supply the defect thus discovered in the administration of the law, the last Legislature, by an act of March 29, 1895, provided as follows:

"SECTION 1. It shall be the duty of the forestry commission, upon application by the owner or owners of any tract of forest land situated in a locality where no town organization exists, to appoint a suitable number of special fire wardens for said tracts, to define their duties, to limit their term of employment, and to fix their compensation. The expense attending the employment of said special fire wardens shall be borne one-half by the party or parties making the application for their appointment and one-half by the county in which said tract of land is located.

"Approved March 29, 1895."

The territorial area of Northern New Hampshire, in which no town organization exists, is relatively large, and much of it is heavily timbered. Hence the enactment just quoted, if wisely administered, promises a larger measure of protection than has ever before been supplied against the ravages of forest fires in the localities where it is most needed.

Investigation of Forestry Conditions.

In order to obtain information to serve as a basis for forestry legislation, the State has authorized the appointment in succession of three Forestry Commissions. The first temporary Forestry Commission was authorized by the act of June 29, 1881, which provided that:

"The Governor, and such associates as he may appoint to act with him, are hereby constituted a commission to institute an inquiry into the extent to which the forests of New Hampshire are being destroyed by the indiscriminate cutting of wood and timber for transportation to other States; also, the effect, if any, produced by the destruction of our forests upon our rainfall, and consequently upon our ponds and streams, and into the wisdom or necessity for the adoption of forest laws."

This Commission, which expired by limitation in two years, was by the act of September 15, 1883, extended for an additional term of two years. Its report, submitted to the Legislature in 1885, treated of the five following subjects:

1. Forest areas.
2. The forests of New Hampshire in their relation to the amount of rainfall, the water supply, and the climate of the State.
3. The trees and shrubs composing the New Hampshire forests, their distribution, relative abundance, and utility.
4. Forest management and reforesting.
5. Forest fires.

It is not improper to add that this report is one of the most valuable of those that have been made upon this subject in any State of the Union, and that the subsequent Forestry Commissions of this State are greatly indebted for the thoroughness with which this investigation was conducted. But public interest was not yet awake to the necessity of further specific legislation for the protection of the forests. The gradual encroachment of the lumberman's axe upon the White mountain forests, several destructive fires along the lines of summer travel in that region, and the realized close dependence between water supply and the growth of our manufacturing interests contributed to keep alive agitation and sufficed to lead to the establishment of a second temporary Forestry Commission. This Commission was appointed in accordance with the act of August 16, 1889, which reads:

"WHEREAS, The preservation of the forests of New Hampshire is essentially necessary, not only for the prosperity of our vast manufacturing interests, but also to preserve and increase that natural beauty of scenery so attractive to our visitors; and

"WHEREAS, The hills and mountains in this State are being rapidly denuded of timber and rendered unsightly by the acts of private parties owning the same; therefore,

"*Resolved*, That the Governor, with the advice of the Council, is hereby authorized and empowered to appoint a commission consisting of three able and discreet men, who shall examine and ascertain the feasibility of the purchase by the State of the whole or any portion of the timber lands upon the hills and mountains in the State, near summer resorts, or bordering upon the principal sources of the water supplies needed for manufacturing purposes, with the view of preserving the same as public lands and parks, and report their finding to the next session of the Legislature."

The report of this Commission, presented to the Legislature in 1891, was based upon a careful examination of the mountain regions of the State, and contained in its first half an analysis of the functions of mountain forests, under four heads:

1. The preservation of the mountains themselves by clothing them with soil.

2. The supply of timber.

3. The formation in the soil of natural storage reservoirs for the retention and distribution of water.

4. The production and maintenance of such conditions of the soil, water, atmosphere and scenery of the region as are highly favorable to human life, health and enjoyment.

And in its second half statistics and discussions relating to the leading natural resources of the State, its agriculture, timber supply, manufactures, the attractions of its scenery for tourists and summer visitors, the railroads in the State, roads and paths, forest fires, and the inter-dependence of our leading industries.

This Commission recommended:

1. That the large expense involved in the condemnation by the State for public purposes, by the exercise of the right of eminent domain, of very extensive areas of its mountain forests, and the undefined limit of the legislative power to authorize the same, render it unwise for the State to proceed far in that direction, and that it confine its action to tracts of small extent, and to those whose condemnation is undoubtedly demanded by the public welfare.

2. That a permanent Forestry Commission be appointed, whose duties should be substantially those now prescribed (An Act Establishing a Forestry Commission, 1893) for the existing Commission.

3. That the penalties for the careless or wilful firing of woods or forests be increased, and that the selectmen of towns be constituted fire-wardens for their respective towns, and that in localities where no town organizations exist county commissioners should act as fire-wardens.

These recommendations respecting fire-wardens also were embodied in the act above cited of 1893.

This second temporary Commission appointed for two years was, by the act of April 10, 1891, extended for an additional term of two years. Its second report, submitted to the Legis-

lature in 1893, contains an extended discussion of the various phases of the forestry question in its relations to the permanent interests of the State, and concludes by suggesting the following remedies to prevent the further squandering of the forested wealth of the State:

"1. That, as favorable opportunities offer, the State should purchase of their owners such tracts of denuded land as it may be deemed advisable for the State to acquire, and forever after hold and manage them in such manner as the general interests of its people require.

"2. That, as favorable opportunities occur, the State should purchase of their owners tracts of forest from which all trees of a stipulated size have already been or may be subsequently removed by the seller; said lands to be forever after held and managed by the State in such manner as the general interests of its citizens require.

"3. The resumption of ownersip by the State through the exercise of its right of eminent domain, of important tracts of land, like mountain passes and mountain summits, to be forever after controlled by its government, and devoted to the enjoyment of the public.

"4. That, as favorable opportunities occur, the State should purchase of the proprietors of such forest property as it may wish to control, agreements restricting the owners and their heirs, administrators, and assigns, forever, to cutting of such trees only as are above a stipulated size."

The third, and present Forestry Commission, was intended to be permanent. It was constituted in accordance with the recommendations of the second temporary Forestry Commission, outlined in its report for 1891. The act establishing this present Commission, approved March 29, 1893, provides that the Commisison shall consist of the Governor, *ex officio*, and four other members, two Republicans and two Democrats, who shall be appointed by the Governor, with advice of the Council for their special fitness for services on this Commission, and be classified in such manner that the office of one shall become vacant each year.

"SECTION 2. It is the duty of this commission to investigate the extent and character of the original and secondary forests of the State, together with the amounts and varieties of the wood and timber growing therein; to ascertain, as near as the means at their command will allow, the annual removals of wood and timber thereupon and the disposition made of the same, by home consumption and manufacture as well as by exportation in the log; the different methods of lumbering pursued and the effects thereof upon the timber supply, water power, scenery and climate of the State; the approximate amount of revenue annually received from the forests of the State; the damages done to

them from time to time by forest fires, and any other important facts relating to forest interests which may come to their knowledge."

Some of the investigations prescribed by the above enactment have been made; others are in progress. A statement of the results of the former has been submitted to the Lgislature in the Forestry Reports for 1893 and 1894.

The law creating the first Forestry Commission provided that its members should serve without compensation or expense to the State: the law creating the second Commission authorized the payment out of the treasury of the State of $1000, or so much thereof as might be necessary for the payment and services of said Commission; the law creating the third Commission provides that one of said Commissioners shall be elected by his associates secretary of the Commission and receive a salary of one thousand dollars per annum. The other members shall receive no compensation for their services but shall be paid their necessary expenses incurred in the discharge of their duties, as audited and allowed by the Governor and Council.

The laws creating these Commissions have required that they make reports to the Legislature, and that these reports be printed for distribution. The information thus supplied to the Legislature was needed before that body could act with adequate knowledge of the evil alleged to be done by forest fires and the lumberman's axe. Now only the rise of a strong public opinion demanding the adoption of more scientific forestry seems to be needed to secure further enactments.

Public Parks.

Since the beginning of the forestry agitation in New Hampshire numerous plans have been suggested for the acquisition by the State of the whole or some parts of the White mountain region, and occasionally of some outlying mountain peaks, and their dedication to the uses of public parks. The large pecuniary outlay which such reservations would involve, and the unwillingness of agricultural communities to increase their present undue burden of taxation for what many of them would deem the especial benefit of the leisure classes, who during the summer flock to the mountains from town and city, have thus far prevented the establishment of such reservations. Their utility as object-lessons in scientific forestry also is appreciated by

few. Still a beginning of such legislation was made in 1893. The Legislature then enacted (An Act for the Establishment of a Forestry Commisison, Sec. 4) that:

"SECTION 4. Whenever any person or persons shall supply the necessary funds therefor, so that no cost or expense shall accrue to the State, the forestry commission is hereby authorized to buy any tract of land and devote the same to the purposes of a public park. If they cannot agree with the owners thereof as to the price, they may condemn the same under the powers of eminent domain, and the value shall be determined as in case of lands taken for highways, with the same rights of appeal and jury trial. On the payment of the value, as finally determined, the land so taken shall be vested in the State and forever held for the purposes of a public park. The persons furnishing the money to buy said land shall be at liberty to lay out roads and paths on the land and otherwise improve the same under the direction of the forestry commission, and the tract shall at all times be open to the use of the public."

Thus far no persons have furnished sufficient means to enable the Forestry Commission to exercise the beneficial power thus bestowed.

Arbor Day, Shade Trees and Forestry Meetings.

Arbor day has not been made a legal holiday in New Hampshire, but its observance has for several years been invited by official proclamation, and its observance is becoming customary, especially by the public schools.

The legislation of this State in relation to the planting, cultivation and protection of shade and ornamental trees requires only briefest mention. The Public Statutes, Chap. 40, Sec. 9, state that "towns shall have control of the shade and ornamental trees situated upon any lands within the limits of the town appropriated to public uses, and may make regulations from time to time for the planting, protection and preservation of such trees." Chap. 50, Sec. 10, gives like power to City Councils. Chap. 59, Sec. 13, allows an abatement of taxes to any person who shall plant and protect shade trees upon any highway adjoining his land. Chap. 81, Sec. 5, forbids the stringing of wires to the injury of shade trees without the consent of the owner, unless upon order of the selectmen, after hearing, and Chap. 147, Sec. 1, authorizes the formation of corporations for "the planting, cultivation and protection of shade, ornamental and forest trees." This legislation was supple-

mented by an act approved March 28, 1895, which provides that:

"SECTION 1. The mayor and aldermen in cities, and the selectmen of towns, are hereby authorized as hereinafter provided in this act, to designate and preserve trees standing and growing in the limits of highways, for the purposes of shade or ornament, and to designate not more than one such tree in every sixty-six feet where such trees are growing, and are of a diameter of one inch or more.

"SECTION 2. Said mayor, and aldermen, and selectmen shall at such seasons of the year as they deem proper, designate such trees as are selected by them for the purposes set forth in this act, by driving into the same, at a point not less than four nor more than six feet from the ground, and on the side toward the highway, a nail or spike with a metallic washer, hung thereon, on which shall be stamped the seal of the State of New Hampshire, together with such numbers or figures as will enable said officers to keep a correct record of said trees. Said washer shall be procured by the secretary of the Forestry Commission, and furnished by him to said officers as may be required by them for the purposes of this act. But nothing in this act shall prevent said officers from removing said trees whenever in their opinion the public good requires it. Said mayor and aldermen, or selectmen, shall at least once each year renew such nails or spikes and washers as shall have been destroyed or defaced, and may also designate in the same manner as herein before directed, such other trees within the limits of the highway as in their judgment should be preserved for ornament or shade.

"SECTION 3. Whoever shall wantonly or intentionally injure or deface any tree thus designated or any of said nails, spikes or washers affixed to said trees, shall forfeit not less than five, or more than one hundred dollars, to be recovered by complaint, one-half of which fine shall go to the complainant, and one-half to the city or town wherein the offense was committed."

The act of March 29, 1893, establishing the present Forestry Commission, requires it to "hold meetings from time to time in different parts of the State for the discussion of forestry subjects." This branch of forestry work, though inaugurated by the second Forestry Commission, under the leadership of its able president, Hon. Joseph B. Walker, and its indefatigable secretary, Rev. J. B. Harrison, flagged for lack of audiences. During the past two years audiences have been easily found by the present Commission, through the enthusiastic co-operation of the Patrons of Husbandry and the State Board of Agriculture, which have placed this topic on the programmes for their regular meetings. The New Hampshire College of Agricul-

ture and Mechanic Arts also has aided in the public discussion of this subject by including in its "Institute Course" for 1893-4 a short series of lectures on Forestry.

Such briefly has been the forestry legislation of New Hampshire. The vital interest of the State in this subject is evidenced by the fact that a larger acreage of its soil can profitably be devoted to the cultivation of trees than to the raising of wheat or any other cereal, by the probability that the completed returns for the census of 1890 will show that its lumber and saw-mill industry is second to none in the State, by the judgment of experts that from an economic view the present system of cutting pursued by the lumbermen is doing incalculable damage, and by the universal opinion that the deforesting of the White mountains must rob the commonwealth of its greatest natural beauty. It is apparent that the legislation described is inadequate for the proper protection of this vast interest upon which must depend so largely the future prosperity of this commonwealth.

PUBLIC MISAPPREHENSION OF THE FORESTRY QUESTION.

By J. B. Harrison, Franklin Falls, New Hampshire.

The careless and wasteful methods of treatment of our forest interests and resources, which have been common in this country, have always had close and vital relations to the general contents of the American mind—that is, to the whole body of ideas, theories, opinions, beliefs and assumptions which belong to the intellectual life of our people. They are features and products of our mental conditions and environment, and belong naturally to the stage of civilization and development which we have reached. We have used our other great natural resources in very much the same way. We have wantonly wasted, and, in many instances, completely destroyed valuable sources of supply for fish and game. The supply of

water for the irrigation of vast tracts or arid land in the western part of our country has been, and still is, seriously threatened by the national indifference to injuries to the mountain sources of the rivers from which this means of wealth must be drawn.

Here in New England our principal mountain streams are being choked and polluted by sawdust and other sawmill refuse, and are being transformed into sewers. Their waters, if they had been kept pure, would be worth millions of dollars to the dwellers in the great towns between the mountains and the sea, and especially to the vast populations which are gathering in the shore lands of Massachusetts and other States. The great White Mountain springs should naturally supply millions of the people in the Atlantic coast cities with pure water for domestic purposes, but the streams from these sources are already indescribably foul and noisome, and their polluted waters carry disease and death to the unfortunate people who have to drink them.

Our mountain landscapes are needlessly defaced and vulgarized, and the attractiveness of our scenery is being steadily reduced, obliterated and destroyed, although this scenery is the source of an actual annual revenue of many millions of dollars for our people.

The general treatment of springs and of small or local sources of water supply, by individual proprietors, is nearly everywhere such as to destroy them entirely, even where they would have a definite and important money value. In New England thousands of such springs have been extirpated. There was formerly a spring at the head of nearly every ravine which leads down from the higher land to the inter-vales, or bottom lands, along the rivers; often a spring every few rods, sending down a never-failing stream of the purest water to help maintain the equable flow of the mightier current through the valley below.

These springs were usually situated where the ground could not possibly be cultivated, as it was too steep for any kind of tillage. If a small area around each spring had been left to the growth of timber the perpetual supply of this product would have been permanent. But the usual course of treatment is to cut off all the trees and bushes, and when the brush has become dry, to burn the ground over, so as to destroy all possibility of the reproduction of tree growth at that place.

In consequence, the slopes above and around the spring soon begin to break away, the surface soil slips down, and the sand or gravel of the hillside spills out and smothers the spring, often filling and burying the entire nook or glen in which the spring was situated. There are now hundreds of these small deserts along our river inter-vales, where once all was verdure, freshness and beauty. Some scientific men hold that all the deserts on our planet have been created by human agency. I do not know whether this is a correct opinion, but my fellow-citizens in New England are still engaged in the business of desert making.

Our treatment of the soil itself, the greatest of all our natural resources, has been to a very great extent wasteful, reckless and unintelligent. My neighbors burn their fields over every spring, wherever their is a sufficient film of grass, weeds or stubble to lead the fire over the ground. This burns out the fertility of a thin stratum of the surface, and this is ploughed under each year, and at the same time a new layer of the soil is turned up which will be subjected to the action of fire at the opening of the following season. The land thus treated grows whiter and sandier, as cultivation progresses. The owners buy increasing quantities of "commercial fertilizers," and complain of the diminishing fertility of their fields. Not long ago I saw almost the whole length of the valley of the Red River of the North ablaze with burning wheat stubble and straw.

Every year scores of people are burned to death in this country, and property of the value of many millions of dollars destroyed, by fires which might easily have been prevented. The causes of such fires belong to two classes—those of faulty construction of buildings, and those of inadequate care of stoves, furnaces and fire-places. It is *a little cheaper* to build houses and stores, so as to invite the resistless spread and dominance of any fire once started and so we build them in that way.

Very often a great fire would have been preventd by the employment of night watchmen. But that would cost three or four dollars a night, perhaps; so the owner or occupant hopes it will be all right, and takes the chances, and the building burns. Multitudes of our people think there is no actual loss when property in any amount is destroyed by fire, *if it is fully insured.*

The ideas, notions and practices of our countrymen in relation to our forest interests and resources are not exceptional or peculiar. They are of a piece with the general intellectual character and possessions of our people. "The spendthrift's childlike faith in the inexhaustibility of his patrimony" is a strong belief in the general American mind, and it is a potent influence in our national character and action.

A large proportion of the intellectual possessions of the American people consists of notions, ideas, theories, assumptions and beliefs which will not bear any searching analysis. This is not only true of the masses who work with their hands for wages, who have little time or opportunity for culture, but it is true also, to a great extent, of most of our "educated people" as well. Since our civil war no exigency has arisen to compel us to "take account of stock," or to examine and revise the mass of incoherent and undeveloped "views" and fancies, which have in various ways come to be taken for granted, and which now fill a great deal of room in the average American mind.

Chief of all these, and most important in its bearing on our methods of managing our national resources, is the fantastic trust in the omnipotent power of science to deliver us from all need of care, toil, economy and foresight, and to make good all the losses caused by wanton waste and stupid destructiveness. We destroy, instead of preserving, forest conditions on our mountains, because the mass and average of the American people believe that science is almost certain to provide adequate substitutes, not only for food and timber, whenever such substitutes are needed, but for everything else which we waste and destroy.

We look to science to bless our disregard of economic and moral laws with all the rewards of wise and orderly living. The natural effect upon character of such a belief is the breaking down of moral distinctions and the emancipation of the mind and will from obligation, and this effect is already widely manifest. The full consequences of this mighty transformation in thought and character will probably unfold themselves gradually. But the people who cherish this entirely unscientific trust in science are very numerous; they are our fellow-citizens; they have votes, and their dreamy faith in unrealities ap-

pears not only in our treatment of our forest interests and resources, but in national legislation and policy regarding other important departments of our national life.

Our forestry problem in this country, like most of our other serious problems, is largely a psychological problem. Any great and permanent gain in our methods of dealing with our natural resources must be based upon, and result from, a substantial improvement and advance in popular thought; and this can at the present time be brought about more readily than has ever before been possible. We need more effective agencies and methods than have yet been brought into operation for the education of the American mind. We should continue and extend the use of all the means which have been found efficient for the diffusion of knowledge and the propagation of ideas, and should employ some additional methods, adapted to more rapid and thorough operation.

Mr. Bryce, in his admirable book, "The American Commonwealth," remarks that "associations are created, extended and worked in the United States more quickly and effectively than in any other country," and he recognizes their value as "organs for focusing and propagating opinion." The American Forestry Association is exactly such an organization as Mr. Bryce had in mind. Such an association can take any substantial idea, which admits of brief and clear statement, and can put it into the minds of all the people of the country, so that they will think about it and talk about it. Of course, we must have money for printing and postage in order to undertake such educational work, and it is much to be regretted that some of the rich men of this country who have gone on founding miserable little colleges where there were already too many, should not have preferred the much more effective and valuable educational work which I have here indicated.

The American people are accessible and teachable in a very high degree. Never were there anywhere in any former time seventy millions of people so ready to be impressed and influenced by anybody who cares enough about any substantial idea to try to propagate it, and who, in his efforts for that object, will show respect for the natural laws and methods for the propagation of ideas. There is no special, inherent or insurmountable difficulty to hinder or obstruct the educational

work which is so greatly needed in this country to promote rational methods of treatment of our forests and other sources. It would be a great benefit to our national interests in many ways if the American Forestry Association were enabled to undertake and prosecute this work of universal popular education regarding the whole subject of forest interests, resources and functions in this country.

There is a pressing requirement for some more specific and adequate plan and order of exercises for the observance of Arbor Day. When the day was to be celebrated for the first time here in the Eastern States, very few of the persons who kindly arranged the order of exercises knew much about forests and trees, except that they were the source of our lumber supply, and very few had any definite notion of the objects for which the day was instituted. As a result, we have a great deal of oratory and music and sentimental poetry on Arbor Day, but very little instruction; and, usually, no care is taken of the trees planted on that day, so that most of them are dead when the day comes around again.

The trees should be planted before hand, by some competent person, when it can be done carefully. A man can plant a tree properly with half a dozen school children watching him, and they may thus learn how to do the work themselves. But no man is likely to plant a tree rightly when two hundred people are looking on, impatient for the more sensational features of the Arbor Day programme. When we consider the careful, unhurried manner in which a tree should be planted, it is obvious that music and oratory are not much more suitable accompaniments than they would be for the work of milking a cow. In this State, and in some others in New England, Arbor Day has been used in several instances, both last year and this, by those who are opposed to the movement in behalf of the rational treatment of our mountain forests, as an opportunity to attack the very objects for which the day was instituted.

We need a kind of "Ritual" or "Liturgy" for our observance of Arbor Day—a responsive reading, in which the audience can take part with a leader. This, with a brief preliminary general statement, would enable us to make sure in all cases of having the primary and essential facts, ideas and objects with which the day is concerned, *plainly* set before the people in attend-

ance, and especially before the children and teachers of our public schools. Everything should be plain, with no attempt at oratory or eloquence, no sentimental vagueness, no statistics: they put people to sleep.

IN PATHLESS WOOD.

By Edward L. Berthoud, Golden, Colorado.

For nearly two years in our early twenties we lived in the hot-house forests of New Grenada; the last year of our residence was in a shingle-roofed frame house built of Maine pine lumber, on a clay bluff over forty feet in height, rising from the water's edge of Chaques river. Except for the railway clearing, which gave a vista of about one-fourth mile each way, we were surrounded by a vegetable wall of deciduous and palm trees, linked by a tangled mass of liemas and prickly undergrowth. Terrestrial plant growth, and the gay parterres of varied flowers so common in the northern woods and groves, were almost totally wanting; and even in the few open savannahs the variety of genera was limited. To get a fair idea of the peculiar species of herbaceous growth one was compelled to look upwards, and his search was fructuous and ever-changing; plant growth, checked or eliminated by the dense opaque shade, became arboreal and parasitic, while the floral treasures of the enormous lofty trees were out of reach from the botanical collector. With all this exuberant growth was a legion of insect life, flying, creeping, buzzing and scavengering in every direction, enlivened with the harsh screams of parrots and parroquets and toucans, doves, tropicals and gallinaceae. The recesses of these giant woods teemed with life and growth, but rendered an excursion intolerable to the unacclimated.

We will not attempt to describe the almost untold variety of parasitic growth of orchids, heliconias, arums, cacti and ferns that each tree carried in profusion; nor to attempt to

name their endless changes of form, perfume, foliage and color, which defy computation. It is enough for me to say that we were dazzled, as well as depressed, over the mixtures of plant life which seemed abnormal, yet so bizarre as to lose the seal of quiet beauty that the lovely flora of the northern woods of the United States, or of the secluded valleys and mountain tops of our Rockies exhibit everywhere. We seemed at the equator to be carried back to the forests of the carboniferous age, for along the river Chaques the multitudes of saurians, the huge snakes, the quiet tapir, timid in his solitude, the water teeming with fish, gave a good idea of the jungles of a former age, while around the clearings and savannahs the few scattered fruit trees were alive with monkeys reveling in liberty, the putative ancestors of coming races of men, the undeveloped fathers of future tribes of American aborigines.

Yet this magnificence of tree and plant growth was wanting in restful pleasure and minute beauty, conveying a sense of feeling that this was a war of destruction between animate and inanimate life, in which man and animate life were largely inferior, and the survival of the fittest not yet determined.

Turning from this digression on the aesthetic view of tropical vegetation, I will introduce my reader to a bit of woodland reminiscence, such as yet can be occasionally seen and enjoyed in a Rocky mountain forest, on some of the affluents of South Platte, such as the valleys of Clear or Bear creek, about latitude 39 degrees, 35 minutes north. In the words of Longfellow, here is "the forest primeval," at an altitude above the more temperate valleys of the foothills, yet more than 2000 feet below that varying factor, the line of tree growth.

The forest is composed of the several species of pine, spruce and Douglas Fir, with Aspen groves and a scanty growth of alders, birches and willows on the more marshy borders of rivulets, eked with an occasional clump of Vine Maple or Dogwood. The groves are generally composed of tall trees in the full vigor of growth, and in such close proximity we were constantly obliged to force ourselves between their trunks sideways. Subdued and restful was the impalpable music of the forest; no insect could be heard except an occasional deer fly, while overhead squirrels, wood-peckers, cerulean jays, Clark's crows, cross-bills and pine finches kept up a clatter of subdued

music and rapid blows, varied with the notes of a large wood pigeon or the booming, sad call of doves; by and by we are startled by the loud rush through the trees of a timid dusky grouse disturbed from its bearberry patch, while in an open glade we see the recently scratched up holes of some errant bear digging its favorite valerian roots, or the twisted and tangled top of an Aspen sapling, a mark of the playful work of an elk polishing his antlers; all bear the impress of insouciant first creation, before man, the egotistical last creation, brought death and fell destruction upon animate and inanimate nature.

But listen!—a loud crash is heard; we hasten to ascertain its origin; a venerable fir tree, an ancient of days, has reached the apogee of its existence— dry and withered, its bark wrinkled with age, a giant of the forest whose shattered head has faced the storm of numberless ages, now lies prone in its soft bed of leaves and humus. Overborne by the weight of self, and deeply decayed, its woody fibre deprived of cellular strength, it has returned to the earth, from whence it came.

But another surprise awaits us; this ancient fir has most unmistakably run the full course of local life; presumably we shall see around it a group of its descendants ambitious to overtop the forest, like their prone ancestor; to our surprise we find none; the Aspen, the pine, the Spruce, surround the site of the dead monarch, with maybe one or two struggling saplings of fir, which are silently and imperceptibly elbowed out of their paternal grave and seem to be considered by the more vigorous growth around as orphans unworthy to succeed their decaying grandsire; and we can here say that in the Rockies, as well as in the San Juan and Wahsatch mountains. Aspen groves die when a size of from $1\frac{1}{2}$ to $2\frac{1}{2}$ feet diameter is attained by them, and fall down, preparing a rich, fertile bed for a succeeding generation of pines and spruces, nature's rotation of tree crops. With trees, as with other created inanimate and animate beings, the cycle of life is limited; eternal life no more belongs to them than to anything else in creation; and when ,after growing for 50 or 100 or 500, or even 1000 years, a time arrives when their powers of assimilation become more and more difficult and weakened, their time is not far off, and from sheer exhaustion and weakness they totter and fall, their course has run.

This is no ideal picture I have drawn; when I lived on the banks of the Chaques river, or in the interior forests of the Jothums of Panama, daily and nightly the spontaneous fall of old forest trees was heard, and although they were covered with leaves and parasites, and seemed as vigorous as their neighbor, yet they crumbled to pieces, weakened and decayed almost to the bark.

Heretofore we have, in our Rocky Mountain forest, given to our readers what we might call the aerial romance of the forest, but we have not spoken of the voices of the forest in the night, when animal life has gone to rest. These are various and at times cadenced, the friction of two crossed limbs, the grating of two tree trunks inclined in different ways, the switching, distant moaning of the night breeze in the pine tops, the strident whistling of a current of air transverse to a rotten knob-hole, or wood-peckers boring in a decayed tree, all mingle, and elicit attention during the wakeful hours of camp life, and at times, lulled to a whisper, seem the voices of distant denizens of the forest glades, or conferences of the unseen spirits of the air, whispering over the appearance of strange visitors. Shakespeare, I think in "Tempest," alludes to the voices of the forest when he speaks of the fairy Ariel enclosed in a tree—"Thy groans did make wolves howl." Two hundred years ago or thereabouts, Cotton Mather said that the devil was the "landlord of the wilderness;" while the good, honest Hollanders in New York State believed in "spooks" roaming around the secluded dells and woods of the Hudson and Mohawk. For ourselves, we stoutly maintain, like Darwin's Fuegian, that there are no "devils" in the Rocky Mountains; in fact, the old landlord of the wilderness has thrown up his lease and departed for lower altitudes.

One more point which we have touched concerns the humble flora of our Rocky Mountain trends and ridges—a flora, though exiguous, yet attaining a brilliancy, a beauty of form, and in some species a deliciousness of perfume that excels the heliotrope, the mignonette, or New Orleans violet. As to color, what can be more gorgeous than Parry's Primrose, or the bright crimson of the Painted Cup, the delicate blue of the Mertensia or the azure of Larkspur, and the velvety brown and yellow of the

Erysimium, all stealing their brilliant hues from the rays of an intense sunlight?

Once I heard an unlettered miner, enthusiastic over the beauties of a snowy range nook, where Myosotis, Silene, Phlox, Gilia, Saxifraga, and Sedum Sibbaldia gemmed the rocks, none over an inch high,exclaim: "I'll be dog-goned if them ain't dandies!"—his most hyperbolical expression of their minute beauty. Creeping under the trees, or gemming the green moss, the Twin Flower (*Linnea borealis*), the Kinnikinnick, the several Pyrolas, Moneses with perfume perfectly indescribable, the Ladies' Slipper, the Dudecatheon, lovely Calypso borealis, the red Geum, with hosts of Gentians, Pediculares, Calthas and dwarf Kalmias, to be appreciated must be seen in their native habitat, a good setting for this miniature garden.

When, however, we reach in a Rocky mountain forest the limit of tree growth, a limit which varies over 1600 feet according to location of slope, in reference to the sun, and to prevailing winds, we find far above the present limits in numerous places the decayed remnants of former forests that extended higher than present rules, while whole groves of firs and Canada Balsams uprear their ancient moss-covered summits at the limit of tree growth, yet scarcely one sapling is found a straggler in the ancestral shade.

This, we confess, we cannot satisfactorily explain, unless we assume that a slow movement of elevation is still going on in the lofty ranges of our Nevada. Either this, or a slow lowering of yearly and winter temperature, which would accompany increased elevation, may account for this phenomenon.

This narrative in truth gives the impressions that twenty-five years ago could be all experienced in a two days' trip. Today, alas, the forest primeval is fast disappearing. The picture I have attempted to trace of the peculiar features then seen in these secluded nooks and valleys has undergone changes in many of them that are the fell destructive results of fire and the wasteful destruction of the itinerant sawmill—the meanest and least defensible, dishonest occupation that anyone can undertake—where, under color of settlement, valuable timber, the property of the nation, is taken for the sordid gain of one to the detriment of thousands, with its accompaniment of forest fires intentionally kindled to burn the refuse timber left after log-

ging, in order to reach more timber to purloin from the public domain. Can our Representatives stand by and look on, and give no remedy for this public wrong, which, in its future influence on cultivation and water supply, is ruinous and disastrous?

One hour's work can destroy a valuable tree which takes a full half century to grow, and one forest fire destroys the vegetative power of a given area that a century cannot restore.

CO-OPERATIVE FORESTRY.

By George B. James, Boston, Massachusetts.

The true preservation of the forests lies in conserving their growth, utilizing mature and marketable products, and in a management which shall secure a proper rotation of valuable trees, and an annual income, permanent in character.

Individual ownership of woodlands is the bane of American forestry. In the old world the preservation of the forests is considered one of the first interests of society, and consequently one of the first duties of government. With us our republican form of government has not yet assumed that paternal character which would guard the forests, conserve the rain-fall, and modify the climate.

Rational forestry demands methods covering generations, far-reaching, comprehensive—beyond the limits of a single generation. The policy of the individual in dealing with tree growth requiring a century or two for maturity is apt to be narrow, wasteful and short-sighted. His selfish interests or necessities demand an immediate slaughter of all the forest growth under his control. Either his experience or his education determine that one crop from his forest area is all he seeks. He is then willing to abandon his land, or sell it for a mere song.

Co-operative ownership of forest areas secures permanency, methodical work, with results beneficial alike to the community, as well as to the individual.

An object-lesson in forestry is needed by present owners of woodlands. They need to see an exemplification of proper methods. They have much to learn in the wise management, proper cutting and maintenance of subsequent growths of their wooded areas. In the era of forest abundance it seemed unnecessary to the average lumberman to give any thought to future supplies. Approaching scarcity and advancing values render them willing listeners to the gospel of rational forestry. A few co-operative ownerships of forest areas, managed with intelligence, and inspired by public spirit, would work like leaven in lifting the whole industry from the slough of waste and improvidence to the higher plane of intelligence and remuneration. The present generation of lumbermen should be taught that there is a better way to utilize their forest areas than that which they have employed in the past.

Co-operative ownership and management of forest lands are well exemplified in the workings of several clubs in the Adirondack Mountains. Here pleasure and profit have combined in showing proper methods in utilizing forest products. The original investments in the stock of these clubs have been largely augmented by increasing values. Such operations have done much to attract the attention of the general public to the value of associated effort in the ownership of forest lands. Preservation of forests must come about largely by the absolute purchase of lands either by nation, State or associated capital. Public policy dictates the conservation of the forests; yet we have no national or State laws which enforce such a policy. Hence for the present we must depend upon co-operative work and ownership in this important matter. Public-spirited citizens are banded together in associated effort for the health, morals and progress of the community. Similar plans of co-operative work are necessary in setting examples of effective forestry practice. The public is fast coming to understand the importance of the forests in the nation's economy. The next step must be to unite patriotic citizens in the good work of their preservation.

Here and there a wealthy individual devotes time and money in the establishment of a park, preserve or forest reservation. The example is good, and stimulates further development on similar lines. More effective work may be accomplished

through the voluntary contributions of one hundred or one thousand associates, whose aggregate subscriptions may be sufficient to buy one thousand or five thousand acres of available and accessible forest lands, to exhibit the teachings of intelligent forestry. It ought not to be difficult to secure the active co-operation of five thousand individuals out of a population of 70,000,000 people.

No class of property is more attractive at present cost, none more certain to advance in future value, than forest lands. American forest lands are now selling at prices far below European values, and yet the consumption of forest products in this country is many times greater than that abroad. We are already engaged in the rapid slaughter of the last half of our original forest areas. In the old world forest lands are selected by rich families as entailments. Future generations will profit by these wise investments.

The immense increase of wealth points to a higher range of values in real property, and consequently to diminished income. The attention of wealthy men should be called to the desirable nature of investments in well-selected woodlands in this country. Associated effort has developed our railroads, canals, mines, navigation and manufactures. Corporations are absorbing individual industries, thereby cheapening production, increasing the output and placing many important articles of daily use within the reach of men of moderate income. Fierce competition is reducing profits to the smallest percentage. There is need of other fields to conquer, and investors are looking about to seek investments which promise security and income. Would that the forest products of the country could be grown and handled and manufactured with the same capital, skill and method as prevails in the cultivation of cotton, wool, sugar, and their subsequent conversion into products for almost universal consumption!

No other industry has received so little attention at the hands of associated capital as the ownership and care of our forests, and yet none presents a better field to the investor. Its products are staple, necessary and salable; its growth under proper conditions continuous and remunerative. Ripe trees are beyond immediate competition, as their mature growth demands a hundred years or more. New uses for forest products are

developing; the demand for wood pulp and paper alone consuming half of all the spruce cut in the country. Managed with skill and care, our forests would yield double the present harvest in a term of years. Intelligent ownership, backed with sufficient capital, would give our American forests such a money value as to present one of the most tempting investments within present reach of co-operative desire. Co-operation in forest ownership would make available men of the highest skill, education and experience, as managers, the most improved machinery and transportation facilities for marketing forest products. In all these ways co-operative effort would have the advantage over individual operations, hampered by insufficient means, inferior machinery, and uneducated managers.

The establishment of clubs, Alpine societies, forestry associations and co-operative ownerships of our most important mountain forests will prove healthful, remunerative and patriotic. Around such an organization would crystallize a mighty movement, which would eventually influence State and national legislation, guardianship and ownership. A healthful public sentiment needs to be created in forest matters. This sentiment must have a rallying point in practical work, associated ownership and visible results.

Our forestry associations should not confine their important work alone to the spoken word and the printed page. Too much dependence has been placed upon the sentimental side of this question. This is all important at the start, but soon loses its convincing power in the minds of practical men, without some display of actual results. Without some plan of co-operative ownership eloquent protests against present forest management are all in vain. The force of example is most potent. Our forestry associations must show the courage of their convictions in the ownership of even limited areas of woodlands.

Let us imagine the power and influence which the American Forestry Association could exert if, in addition to its present valuable work, it could formulate and secure the subscriptions of thousands of public-spirited investors in co-operative holdings of forest lands. Such an important work is worthy the careful consideration of the association. Let it systematically seek subscriptions from citizens of every State in the Union, and let an appeal be made to the leading citizens of our Repub-

lic to stamp the enterprise with their approval and their liberal contribution. Such a co-operative movement would have a mighty influence for good. It would enable the best minds in the country to inaugurate a forest policy, adapted to our soil and climate. It would eventually result in the establishment of a forestry school, broad, wise and patriotic. It would show to the country that the American Forestry Association could lead a movement illustrating the advantages of practical forestry, as well as the cultivation of the sentimental or aesthetic side of the forestry question.

THE RELATIONS OF INSECTS AND BIRDS TO PRESENT FOREST CONDITIONS.

By Prof. A. D. Hopkins, Morgantown, West Virginia.

Forests under natural conditions, or, in other words, those unaffected by the advent of civilization, appear to be under the control of certain laws of nature which govern the vegetable and animal species therein in such a manner that a harmonious balance is usually preserved. No species of the vegetable kingdom is allowed to suffer severely from the undue increase of its enemies in the animal kingdom. Few, if any, species of the animal kingdom become extinct on account of a failure of their food, or from the attack of their natural enemies. A continued battle of the species exists, but it is a war in which none are conquered and none are conquerors, each species battling for its existence makes possible the existence of some other species; thus a balance is preserved.

This may be the rule under natural conditions, and all may go well until the unnatural conditions following the advent of civilization brings about a change. Then nature's laws are broken, obscure species of insects and plants come to the front, and others which were formerly abundant disappear. In the confusion, certain enemies of plants are for a time exempt from

the attack of their enemies, and are left free to commit desperate ravages upon some species of vegetation; others, from a lack of a sufficient supply of their natural food, change their habits, and infest plants of an entirely different character; thus they escape for a time their enemies, which had previously kept them within proper bounds; others are introduced from foreign countries. Their enemies having been left behind, they invade our forests unmolested, except by man, until some of their old enemies are introduced, or they acquire new ones here.

When the process of clearing the land commences, new conditions are presented to the forest insects which are most favorable to their increase. The girdled trees in clearings, the logs, stumps and tops, and the injuries to standing timber by fire, all contribute to their multiplication, some of them changing their habits from that of infesting diseased and dead timber, to that of attacking the living, and through their numbers they are enabled to kill trees on their own account.

Some ten years ago, when the West Virginia Central & Pittsburg Railroad was being built through a portion of the spruce forests in our State, the timber along the line commenced to die from the attack of insects, and the trouble continued to increase and spread during the next three years until thousands of acres of some of the finest timber in this State was killed. Only four years ago an invasion of the destructive Pine Bark Beetle, starting somewhere near the line between West Virginia and Virginia, in Rockingham or Hampshire counties, spread like a conflagration over these and adjoining States wherever the pine grew. The pine timber on hundreds of square miles was killed, causing a loss of property having a value of more than a million and a half dollars. Similar devastations have taken place in Maine, New York and New Brunswick, and in the forests of Germany and France. Most, if not all, of these destructive invasions were occasioned by unnatural conditions brought about through the influence of man.

With the existing conditions in our forests, as previously mentioned, the opportunity offered for the breeding and multiplication of forest tree insects being most favorable, we are confronted with the problem of preventing damage and loss from the ravages of the obnoxious kinds.

Never was there a better time to study the intimate relations of forest-tree insects to certain forest conditions. Neither can there be a better time to obtain knowledge of the characters and habits of forest-tree insects, with a view of utilizing this knowledge in the future system of forest management, which must necessarily follow this age of forest destruction.

With reference to the relation of birds to certain forest conditions, I realize that I will be trespassing upon a sacred and much lauded faith among our people, that birds are our greatest friends as insect destroyers, when I say, that from my own observations, I am ready to conclude that in the end they have very little, if any, beneficial influences in the prevention of insect depredations in our forests. That insectiverous birds obtain the larger share of their food from the insect world, and that they devour immense numbers of insects and other small forms of animal life, no one can doubt. They are not, however, our friends to the extent that they will devour those only which we look upon as injurious. In truth, they make no choice between those which are beneficial and those which are injurious. They capture alike the parasites of the injurious species, the parasite of the parasite, as well as the injurious species; hence it would appear that in the end no good is accomplished. They merely take the food nature has provided from the ranks of the insect armies of opposing forces, and neither one force or the other thereby gains an advantage.

One class of birds known as Woodpeckers, which, by the way, are recognized above all others as exercising the greatest benefit to mankind in the destruction of wood-infesting insects, are not so beneficial as we have been led to suppose. My attention was forcibly called to this fact during an investigation with reference to beneficial forest-tree insects in Germany in 1892, where I was seeking for an enemy to introduce against our destructive bark beetles. I determined that a certain species, a Clerid Beetle, was by far the greatest enemy of European bark beetles, and was successful in finding a forest in which they were common. I was surprised, however, to find that the Woodpeckers were the greatest enemy of the Clerid. The larvae, pupae and adults of this beneficial insect had occurred in great numbers in the bark of small pine trees that had been broken by snow the previous winter. They had destroyed

most of the bark beetles which had infested these trees, and had gone into the outer bark near the base of the tree to make their cocoons in which to pass the winter. It was in those trees only which had escaped the attack of Woodpeckers that I succeeded in obtaining specimens. In some places not one infested tree in twenty had escaped the birds, and in those they had attacked, apparently not a Clerid in one hundred had escaped them. This observation led to subsequent investigation with reference to the habits of Woodpeckers, for the purpose of ascertaining their true relation to injurious insects and to trees. It has been determined that they do not peck holes in the bark of healthy growing trees (a common habit with some species) for the purpose of obtaining insects, but do so for the purpose of securing the inner bark and sap for food. I have seen trees that had died on account of the quantity of bark that had thus been removed from around the trunks. I have recently discovered that an injury to the outer sapwood, caused by them while thus engaged, results in a common and quite serious defect in the wood of different kinds of trees. I have also determined that what is known as Curly Poplar, a curled and wavy condition occurring in the wood of Tulip Trees, is the result of the punctures in the bark made by these birds.

FOREST FUNGI—ANTHRACNOSE OF POPLARS.

By Dr. B. D. Halsted, New Brunswick, N. J.

Forests do not escape the attacks of fungi, for nearly every tree has one or more of these parasites preying upon it. Among the most conspicuous of these fungous enemies are those that produce gall-like structures of the stems. Of such are the "apples," so-called, of the cedar trees, that are brown enlargements of the small branches, and become covered with large yellow, gellatinous horns in spring time.

Other conspicuous twig enlargements are the black knots upon the stems of the cherry. Both these and the galls upon the cedar have an economic importance beyond that of the forest, for the fungi producing them grow upon orchard trees. Thus the cedar galls give rise to the leaf rust of the apple, while the black knot is often very destructive to cultivated plum and cherry trees.

It is, however, to the leaf parasites that attention is more particularly called at this time, for of late some kinds of forest trees have suffered greatly. During the past few years the Sycamore or Planetree (*Platanus occidentalis*) has been almost defoliated by a species of anthracnose known to science as *Gloeosporium nervisequum*, (Fl.) Sacc. This fungus has been studied by European and American mycologists, and its habits are fairly well known, and recorded in the books. An account of it may be found in the Journal of Mycology, Vol. V. So prevalent has this leaf-blight become that the Sycamore trees present an unsightly appearance, not only the foliage, but the young twigs becoming blighted by the fungus.

A similar anthracnose (*Gloeosporium saccharinum*, E. A. E.) has increased upon the maples until they, especially the *Acer saccharinum*, show their foliage in a half dead condition early in the season.

In like manner the oaks have their foliage blighted. The white oak (*Quercus alba*) often has its leaves brown by the attacks of (*Gloeosporium canadense*, E. A. E.), so much so, in fact, as to suggest the work of a fire, and, of course, is quite destructive.

It is seen that the three last-mentioned diseases of forest trees are all caused by members of the same genus, and they produce results upon the foliage and young twigs that are quite similar.

Special attention is now called to a blight of poplars that is due not to a Gloeosporium, but a fungus so closely related as to be in a neighboring genus: namely, *Marsonia populi*, (Lév.) Sacc.

The most evident thing in connection with this blight is the killing of the small lateral twigs, and the portion of the main stem where these twigs join it. When this dying of the growing layer of the main twig is extensive the tree is ruined. The

dying of the bark in patches along the main stem was the first thing observed by the nurserymen, and at first sight it seemed likely that the destruction observed was due to Bacteria which made their entrance at these points; but a further study of the disease, and an examination of the plants in full leaf made it evident that the trouble begins in the foliage and then descends through the leaf stalk to the small side branches, and then on to the main stem.

This fungus, one of the anthracnoses, most likely makes its entrance through the openings (stomata) of the leaves, and spreads from there by means of minute filaments which occur through all parts of the leaf and other portions of the plant. A leaf that is badly anthracnosed shows minute specks over its entire surface, and does not give the appearance of many of the other sorts of leaf blights where the disease seems to start from a single point. The spores of the Marsonia are produced in great abundance in the little specks upon the leaf, and are poured out upon the surface, and then washed away by the rains, or carried, when dry, by the winds, so that there is ample opportunity provided for the spread of the anthracnose of the poplar.

It is evident that a plant which has the twigs so diseased as to be almost lifeless is of no commercial value. It is possible that, by cutting the affected side branches, the main stem will recover fom the injury it has received, and thereby a good plant may finally be produced; but as in many other cases of this kind, when a plant is diseased, it is quite apt to have the threads of the fungus so thoroughly scattered through its tissues that there is great probability of its remaining a blighted or anthracnosed plant throughout its life.

This *Marsonia* is common in Europe upon several species of the genus *Populus*. It also grows in this country upon a number of our poplars, both wild and cultivated. The wild poplar (*Populus alba*) is particularly subject to this parasite.

The presence of the *Marsonia populi* in the dying twigs of the nursery poplar trees was demonstrated microscopically, July 14, 1894, and there remains little doubt, if any, that the destruction among the nursery poplars is this anthracnose.

THE PREVENTION OF FOREST FIRES.

By Gen. C. C. Andrews, St. Paul, Minnesota.

A Report on Forestry, by Dr. Hough, published by the United States Government in 1877, devotes several pages to the fearful ravages of forest fires in several of the States. Official reports by the Chief of Division of Forestry, Department of Agriculture, pulished in 1887, 1888 and 1890, also devote attention to the same subject, and show that the loss from forest fires in the United States amounts to the enormous sum of $25,000,000 a year, a sixth part of which is occasioned by fires started by railroad locomotives. The subject will be found frequently treated of in other official documents and in the columns of the various forestry periodicals.

Attention has been freshly drawn to the subject by the dreadful forest fire which raged in July, 1894, in Northern Wisconsin, devastating especially the county of Price, wiping out the town of Phillips, its county seat, and causing most pitiable distress to a great number of people and the loss of many lives. It is difficult to imagine the horror of such a catastrophe. It is difficult to imagine the dismal appearance of the blackened ruins, the chaos of obstruction such a fire leaves for a generation or two, or the apprehension, terror and suffering of inhabitants whose lives it endangered.

This recent calamity calls to mind the awful forest fire which raged in Northern Wisconsin and Michigan during the first half of October, 1871, and which destroyed not only many million dollars' worth of timber and other property, but the lives of 800 people. The *London Daily News*, in an editorial at the time in regard to it, used the expression "That terrible phenomenon of the Western World, the forest fire!" Well, indeed, might any enlightened writer exclaim, "That terrible phenomenon of the Western World, the forest fire!" These fires occur with greater or less intensity every year, and are treated as a sort of nine-days' wonder—deeply lamented and quickly forgotten. For the American people thus to allow such calamities to habitually occur, without adopting any adequate

means for their prevention, causes our country to be regarded as in some respects only semi-civilized.

Of course, forest fires sometimes occur in countries which maintain systematic care of forests, but not so frequently nor to the extent that they do in this country. In such countries as Germany, France, Austria and Sweden the public forests are administered so as to yield a steady net revenue of about 4 per cent., without any diminution or deterioration of the forest but rather an increase of its resources. Their principal means of preventing destructive fires are the constant *watching and patroling* of the forests by guards, or foresters, who reside in their respective divisions. I have pleasant recollections of observing the clean and thrifty appearance of forests in each of the countries mentioned. An outline of the prevailing system of management is about as follows: The public forests are divided into districts, sub-districts *(Reviere)* and divisions. A district may embrace a large geographical area—a province or part of a province—and is in charge of a forest inspector. A sub-district, which includes several divisions, is in charge of a director, and a division, usually comprising 1200 to 2500 acres, is in charge of a forester, who resides in his division in a dwelling belonging to the government, and who personally, or through an assistant, keeps watch of everything in his division pertaining to the forest. He also attends to its economical details, to the building of roads, to the protection of valuable game and the destruction of noxious animals. He has received a forestry education; he is a government official, of humble rank, it is true, but his position is partly scientific; it is permanent, and he is proud of it, and looks forward, through efficiency and fidelity, to being ultimately promoted. His division is provided with good roads. Underbrush is not allowed to accumulate; in some places belts of deciduous trees are grown, or openings left to prevent the spread of fire. Trespassers of all sorts are excluded. It is personal presence, watching and patroling, and the enforcement of reasonable regulations, that prevent fires. But should a forest fire occur, he is already instructed how to proceed for its extinguishment. There are good means of communication, and he can promptly summon assistance. It is made the duty of all neighboring inhabitants to lend their help. Women and children with wet brooms are

sometimes his effective assistants in beating out a fire. If a fire has gained considerable headway, he can pretty quickly have a belt of timber felled in its path; or, he can meet it by an opposing fire. In those countries which carefully administer their forests there appears to be a moral sentiment against any act or neglect that would cause a forest fire.

The laws of our separate States are not wanting in penalties against setting forest fires, but they are ineffective. We shall never prevent these terrible calamities until public forests in our country are systematically cared for as they are in the countries above named. The pecuniary gain, to say nothing of enhanced national reputation, that would be derived from preventing great forest fires, would pay the cost of management twenty times over. If we are not above going to a new country like Australia to borrow an election law, why should we so long refrain from borrowing of the old, enlightened countries of Europe a few well-tried regulations for the care of forests?

Granted that much of the timber land which is being devastated by fires is private property, and cannot be subjected to government management, that, however, should not hinder the government from adopting measures for the prevention of fires in its own forests. Should the government succeed in such measures, its example would be followed by private owners. If the government would adopt reasonable measures for preventing fires in its own forests, it could more effectively insist that railroad companies should employ guards to extinguish fires set by locomotives, or that appliances should be used to prevent their setting fires.

Shakespeare says:

> "Wise men ne'er wail their present woes,
> But presently prevent the ways to wail."

Forestry friends have been wailing forest woes for many years. As one step for preventing "the ways to wail," I would suggest that this Association adopt a short memorial to Congress substantially like the following:

"To the Congress of the United States:

"Your memorialists, the American Forestry Association, respectfully represent that forest fires annually cause great damage to the timber lands of the United States, and are frequently attended with a great deal of suffering and loss of life; that such fires could be very largely

prevented by the adoption of forest management such as has proved successful in Germany and several other European countries; and we would respectfully ask that suitable legislation for this object may be enacted."

I would also suggest that a committee be appointed by the Association to request the President to consider this subject in his next annual message.

ECONOMIES IN RAILWAY TIES.

By E. E. Russell Tratman, A. M., Amer. Soc. C. E.
New York.

At the meeting of this association at Philadelphia, in 1889, I had the pleasure of presenting a paper on "Economy in the Consumption of Timber for Railway Purposes," referring to the necessity for such economy and the ways in which it might be effected. In the present paper I propose to deal briefly with economies in the use of railway ties, which are an important item in the total consumption of timber for railway purposes. In the first place, let us take a few statistics to whet our appetite for more practical information. In 1892, the amount of forest areas in the United States was about 500,000,000 acres; on an average, 100 ties are obtained per acre of forest, so that 26½ acres must be cleared to supply ties for one mile of new track at 2640 ties per mile. To this we may add 31½ acres for ties for renewals. To insure a permanent supply at this rate of consumption, it is estimated that there should be maintained 113 acres of growing timber to each mile of track. The total length of railways is nearly 180,000 miles, or 230,000 miles, including double and side-tracks. With an average of 2500 ties per mile, this represents a total of 575,000,000 ties in service. The annual consumption of ties for construction and renewals is between 75,000,000 and 90,000,000; while the annual consumption of ties and sawed timber for bridges and trestles represents about 500,000,000 cubic feet of round timber. This is

exclusive of timber for telegraph poles, stations and buildings, fences, cars, etc.

While the aggregate consumption of timber amounts to a serious figure, as can easily be shown by such simple estimates as above given for ties, it is hardly necessary to point out to members of the American Forestry Association that this consumption represents but a part of the total annual removal of standing timber and reduction of the timber resources, owing to the reckless and wasteful methods of cutting, the illegal cutting of timber on government and private lands, and the destruction by forest fires. In view of these facts and figures, and in view of foreign experiences in forestry work, I am impelled to strongly urge the prompt adoption and firm enforcement of a forestry policy by the government, placing the whole control and repletion of the forests in the hands of competent men, who will see that the timber resources are managed in the interests of the legitimate consumers of the present and future.

Now let us turn our attention to the specific question of railway ties. Economy in their use may be effected in several ways: 1. By care in the selection and use of new ties; 2. By care in renewals (so as to insure that each tie is allowed to give its full life); 3. By treating the tie by preservative processes, so as to enable the wood to resist decay; 4. By protecting the wood from the cutting and abrading action of the rail by tie-plates; 5. By the substitution of other material for wood. These we will take up in the order given, merely glancing, however, at their salient points, since a thorough discussion of each would form a paper too long and too technical for this occasion, my intention being principally to call attention to the practical economies which benefit all concerned, but which are not sufficiently well realized.

1. *Selection and Use of Ties.*—On some railways, and in certain sections of the country, the ties supplied from neighboring sources are found to be deteriorating in quality, owing to the fact that the best timber has already been cut. All sorts of wood are used for ties, and the advisability of using the former kinds and qualities depends upon the local prices and the conditions of traffic. Ties are too often considered, even by railway officers, as a comparatively unimportant item in the expense account of maintenance, but in fact the average cost of the re-

newals on many roads already exceeds that of the rail renewals, and is still increasing. The increase is due to several reasons: A, gradual increase in price, due to exhaustion of local sources of supply; B,the marketing of the best timber, so that the poorer qualities are cut for ties; C, insufficiently rigid inspection and acceptance of inferior ties; D, greater local rot and cutting under the rails, due to increased wheel loads and traffic; E, "spike killing," caused by re-driving loose spikes. The last two causes are especially noted on curves. It has been a very common impression that young timber was more durable than old ,and less liable to decay, but really young timber—that is, before the heartwood is well developed—is less durable than older heartwood timber. Sound, mature, well-grown trees yield more durable timber than either very young or very old trees. In hardwood, rapid growth timber is the better; while in coniferous wood, slow growth is the better. The ties should be cut at the most suitable time of the year, and allowed to season for some months. The objections to sawed ties, as compared with hewed ties, are believed to be largely a matter of local experience, and not to be of general application. The specifications for ties should be carefully and intelligently drawn up, and the inspectors instructed to see that the ties conform closely to the requirements. At the same time it should be borne in mind that if good ties are wanted, a good price should be paid for them; and it is false economy to buy a lot of ties because they are offered cheap. The cost of putting in and taking out is the same, and with the cheaper ties this cost is incurred more frequently, besides which the increased frequency of renewals is detrimental to the maintenance of good track. Ties accepted but not needed at once, should be stacked or piled, the bottom row resting on poles or blockings, as, if laid direct upon the ground, several of the lower rows will be affected by fungus growths. The common practice of pulling a tie into place by striking a pick into it should not be permitted, as it opens a place for rot to start. In re-spiking ties in the track, the old holes should be filled with wooden plugs, sand, tar or rosin. Ties will wear out more quickly on curves, and decay more quickly in poor ballast which does not drain well. It will be seen by these notes that there is room for the exercise of care in the selection and use of ties.

2. *Renewals of Ties.*—The renewal of ties forms a larger item in the maintenance expenses than is generally supposed, not only on account of the direct work of renewing and replacing, but also the attendant work on the track, and, as noted before, the cost shows a tendency to increase. If the higher officers are parsimonious and habitually cut down requisitions for ties, the track foremen will leave many doubtful ties in the track; on the other hand, if requisitions are filled without question, there will be a tendency to remove ties that have not served out their full life. In many cases a marked economy has been effected by checking the too common practice of taking out ties prematurely. The foreman should make a count (not a gross estimate) of the number of ties to be renewed on each mile of his section, and should mark such ties, but he should not be permitted to take them out until the road-master or engineer has made an inspection. Records should be kept of the annual renewals, and if any one year a specially large requisition is made, the reason should be called for. It is a good plan to notch or mark the tie to indicate the year when laid, and then in renewals it can be seen how the ties average as to life.

3. *Preservative Treatment.*—Ties are renewed mainly for two defects: A, natural and general decay; B, wear, abrasion, and consequent local rot under the rails. The principal object of the preservative process is to arrest decay, but some processes also harden the timber, thus aiding to prevent failure of the second kind. The principal of most of the processes is to extract the sap from the tie by a vacuum, and then to force into the wood a fluid (such as creosote, chloride of zinc, etc.), which will fill the cells and prevent fermentation and decay. In the vulcanizing process, however, it is claimed that the sap itself is changed to a preservative compound already within the wood. For all impregnating processes the timber should be thoroughly seasoned before treatment, and it is waste of time and money to hastily treat unseasoned timber required for immediate use, though this is sometimes done where preservatives have been adopted, but where bad management or delay in authorizing requisitions have prevented the contracts for ties being placed at the proper time. Some four or five large Western roads are using treated ties extensively. On the Southern Pacific Railway, which has tie-preserving works of its

own, the number of renewals per mile decreased from 243 in 1891 to 240 in 1892, and 205 in 1893, while the requisitions for 1894 amounted only to 145 ties per mile. Of 4000 creosoted Virginia pine ties laid on the Central Railway of New Jersey in 1876, there were 1000 still in service and in good condition in 1894. One of the great advantages of the preservative process is that they enable timber otherwise useless to be made available, a treated tie of cheap wood being in some cases cheaper and of longer life than an untreated tie of better wood. Considering the economies to be derived in economy and efficiency from the use of such processes, it appears somewhat strange that progress in their introduction has been and still is comparatively slow.

4. *Protection by Metal Tie Plates.*—The cutting of the tie under the rails decreases the hold of the spike and shortens the life of the tie, especially on curves. Direct pressure of the rail on the tie would have no effect beyond a slight compression of the wood, but the cutting is due to the slight motion of the rail in its wave action and deflection under loads. This motion abrades and tears the fibres (causing opening of moisture), thus hastening local rot, and on heavy grades this is aggravated by the use of sand on the engines, which is ground between rail and tie. One of the most important and practical of modern implements in railway track has been effected by the introduction of metal tie-plates between the rail and tie, and as it involves only a small first cost, while its effects in economy in ties and track cost is apparent, it has been adopted on several hundred miles of track. These plates not only increase the life of soft (and cheap) though durable ties, but also effect a direct economy in renewals and maintenance of way. At the same time they add to the permanence and security of the track by giving a durable and uniform bearing to the rails, and lessening the disturbance of the track for renewals. On curves they are a great safeguard, as they prevent the tilting of the rails and the cutting of the tie by the outside flange. Without the plates much extra work of maintenance is required on curves to keep the track to gauge. With heavy traffic on a line with many sharp curves, the use of tie-plates has been found to effect an economy in maintenance expenses of 50 per cent. in ties and 75 per cent. in labor. Thin, flat plates will bend and

get loose, and make a disagreeable clattering noise under trains, and the plates must not be too large, or they will make a rough-riding track by interfering with the wave motion of the rails, causing the ties to rock in the ballast. The plates should be firmly fixed to the tie to prevent rattling, and this may be effected by fastenings more secure than the ordinary spike, or by ridges and flanges on the bottom of the plate which will bite into the wood. The former plan is most used with the heavy plates adopted in foreign practice, while the latter is most used here with lighter plates. These lighter plates are sufficient in themselves, but it is much to be desired that improved fastenings should be used with them.

Economy in the use of ties in the ways noted above results in economy in other directions: First, by increasing the life of the tie, it reduces the number to be purchased for maintenance; second, it may enable cheaper and inferior woods to be made practically equal to the ordinarily more expensive and better timber; third, it reduces the maintenance work on the track, not only by reducing the number of ties to be renewed, but also by lessening the disturbance of the track which such renewals involve; fourth, the more permanent condition and surface of the track are conducive to greater hauling capacity of the engines and better riding of the cars. In France, for instance, the annual consumption of ties for maintenance was reduced steadily from 170 ties per mile of single track in 1883, to 84 per mile in 1888, this being due to increased care in selection, improved methods of renewals, the use of the creosoting process, and the introduction of better fastenings, better ballast and heavier rails.

STREET PLANTING AND SHADE TREES.

By Henry C. Bliss, Springfield, Mass.

We have driven out our trees and the peaceful rest of their shade. Let us bring them back, for it is easy with modern means to get to them. If people knew how easy it is to plant trees, and if they realized how valuable these shade trees come to be for perhaps a century, more persons might be induced to

join in the work. Nearly one hundred years ago someone planted a double row of elms on a street that bears the name of the tree in my own town. I cannot imagine how a man with greater ease and certainty could have added so much to the sum of human happiness. The grand elms on Court square, in this city, could have been planted in a day, but the loss of these old trees would put the city in mourning for a year. In one day I have gone into the swamps, with but two men to help, and taken up seventy-five elms. In two more days these trees could be planted with the same assistance. Of course, you must first find the swamp, but this usually requires but a little prospecting.

At first care should be taken to determine the line for the trees, and to that end boundaries must be carefully looked up. Casual paths must be ignored. The trees will be likely to fix things for many years, and new paths are easily made. In the village of Mittineague, in order to have the trees at a uniform distance from the margin of the road, it was necessary to put some directly in the common footpath. The people, however, kindly cared for the trees, and scarcely any suffered on account of their location.

In taking trees from wet ground, you will usually need but an axe, for trees in swampy or wet ground have no tap root, and the fibrous roots are usually bunched near the trunk. Cut the turf, or ground, about a foot out from the tree all around. In nine cases out of ten, the tree can then be pulled over, and with a few more blows of the axe you can separate it entirely from the ground. You will then have your tree with a bunch of root fibres and wet earth about as large as a half bushel basket. Now go to the other end of the tree, and no matter how cruel it seems, cut off its head, say 10 or 12 feet from the roots. Never mind if people say it looks a bean pole, in two or three years its head will come out all right. The roots having been cut off, it should not be left with branches; besides this, with branches the tree is wracked by the wind, and the new root fibres are liable to be torn off.

If the soil is sandy or of gravel where it is to be put, dig a hole for the tree as large as a half-barrel or half-hogshead, and bring enough rich earth from the gutter or the meadows to nearly fill the hole, then put some of the better earth at the bot-

tom, and jaunce the tree up and down until it has fitted itself to a place; spread out the small fibres or roots and pack the earth closely around them; be careful and not jam off the tender roots with your boot or with sticks. Fill the earth in slowly, and carefully stamp or tamp it down to the top. Do not let the roots get too dry, and be careful not to pour on too much water. The native earth should not be washed off from the root; it is a god plan simply to sprinkle the root with water, instead of pouring it on from a pail.

With these precautions your trees will be pretty apt to live. Turn the turf upside down around the trunk, for mulching. The trees at the north end bridge of the city I brought in from the western part of West Springfield, in 1881, and they are planted in sand or gravel filling, but each tree had its own small load of earth at its roots, taken from the adjoining meadow.

The effect of locality is well illustrated with this year's planting. The trees on the north side of this street were taken from the same place, and planted at the same time, with the same care; but the trees with the southern exposure have outstripped them in growth. The North End bridge elms were part of 105 that we put out the first year. In my diary of 1882, when I brought in 150, I noted that all but five of the previous planting were alive. Several, however, afterwards died, and this leads me to say that furnace cinders should not be dumped at the foot of shade trees. Some of the West street elms were killed that way; and the large elm near the Canoe Clubhouse is dying from the same cause. The elms on Tubbs Hill, in Springfield, some 75 in number, are also planted in sand and gravel filling; but each tree was supplied with good earth at the root, and nearly every one lived. I think I put nearly every one of these into the ground with my own hands. I mention this only to show that ten minutes' care at the right time may save the tree, and may stand for a hundred years of shade.

One word as to the place of planting: Do not neglect the streets with poor houses; if they remain poor, they will need the shade all the more. I do not know of a more depressing sight than a poor, sun-scorched tenement in a large town; a cabin in the shade of the forest may, in comparison, be a palace, and to a great many more attractive. It is the surroundings and conditions that make the distinction.

Springfield is fortunate in her shade trees, and the grandest of all her elms. Mr. Phillipe, in his excellent article, quotes Colonel Foot as authority for the statement that nowhere in Europe do elms flourish and attain such large size as in Springfield. They are here for your inspection, and the place where the tree falls; there it does not prevaricate.

In my own town there was formerly the elm of which Oliver Wendell Holmes speaks in his "Autocrat." This tree measures 27 feet around its trunk at the smallest part. On Elm street, in this city, you can see today an elm that one foot from the ground measures 33 feet around; higher up it comes to be 20 feet, and next to the branches is 32 feet around. There is a large elm on the grounds of D. B. Wesson which it is said measures 26 feet, 5 feet from the ground. There is another magnificent elm on South Main street; in fact, you will encounter there magnificent trees in all directions. It is said that the elms on the main street corners of Court square were good-sized trees at the time of the Revolution.

The Druids never loved the oaks better than the dwellers of this valley have loved their elms. They bordered the meadows when the first settler came, they stood by his rude fort, and they stand today by his factory. Strong, self-poised, defiant of storm and responsive to sunshine, they represent the people they have sheltered. On some of these massive trees now living hung the sign of King George. From flint-lock to gatling gun, from stage coach to electric cars, they have been the silent bystanders and spectators or human progress.

Another shade tree, which attains in our soil an enormous size, is the Buttonwood, of the Plane tree family. Mr. Emerson speaks of a tree in Rhode Island which in 1839, one foot from the ground, measured 24 feet around. The second in size, according to the same authority, stood in a highway in West Springfield, and measured 16 feet, 6 inches from the ground. These massive trees spring out at odd places along our roads and streams. I used to suppose that they were common country trees, without pedigree or family history, that had fallen into the procession of trees and vegetation, which Holmes says eventually take up their line of march toward the city, to see what people have been doing in their old haunts. I have found, however, that this tree with a common name has a his-

tory to be proud of. Cimon planted them in Athens. Pliny admired them, and says they were brought across the Ionian sea to shade the tomb of Diomedes. No tree was so great a favorite with the Romans; they planted them in their public ways, and nourished them with wine. It is said that Hortensius arranged to give Cicero a continuance in court in order that he might go and water with wine his trees at Tuscalanum. This tree seems to belong in a warmer climate, or else has not got thoroughly acclimated, for it often gets nipped with the frost, and further set back in its usual tardy leaving out.

I have wondered how it happened that locust trees came to have been planted as shade trees in so many dooryards, apparently some 30 or 40 years ago. I find, however, in reading Emerson's work on the trees in Massachusetts, that these trees had been recommended as having many uses and as being valuable and ornamental. I presume people took this advice and planted them. They have, to a considerable extent, spread out in localities, but the beauty and value have, I think, not been realized.

Then comes the maple. For general purposes, including shade, perhaps it rivals all, and none would be missed from Massachusetts more. It attains to large size in this locality, and it is said, on our hills takes the place of the oak. With the autumn foliage upon them these trees are beautiful beyond description. We have in Massachusetts five species, the Red, the White, the Rock, the Striped and the Mountain. There is another tree deserving more attention as a shade tree than it has received, and that is the beech. This tree casts a dense shade, is clean, has few enemies, and it is said is never struck by lightning. They grow abundantly on our mountains, and can easily be planted in our parks. The horse-chestnut has also come to be notably a shade tree, and one of the finest specimens in the State is to be found near the courthouse. When it flowers in the spring, it reminds you of a grand public Christmas tree. The willow family is still represented among our shade trees to some extent, in its own proper species and in the common poplar.

I have confined myself to these few statements as to shade trees. A full list of our trees is published in the report of the City Park Commisisoners. I wish someone would publish a

hand-book with plates for the easy identification of trees. Many of them are readily distinguished; as, for instance, anyone who can count can distinguish the white pine, with its bunch of five needles; the pitch pine, with its bunch of three, and the red pine, with its bunch of two.

LEGISLATION FAVORING THE PLANTING AND PROTECTION OF ROADSIDE TREES IN MASSACHUSETTS.

By Wm. S. Shurtleff, Longmeadow, Mass.

For many years there have been on our statute book provisions for supplying the waste by decay, design and accident, in our ornamental and shade trees. And lately many aesthetic and prudent persons have so forcibly and persistently presented the importance of preseving our roadside forest—friends to the wise men who go annually to the East, where the gilded dome directs the sun to the proper rising point—that statutes have been enacted and laws made, with penalties appended, for staying and punishing this senseless slaughter and for replacing the victims of our past prodigality and fool economy. It only remains with those who approve of this legislation to join with its authors in enforcing these provisions.

It is permissible, and perhaps necessary, to state these laws as they now stand on our statute book.

Chapter 54 of the Public Statutes provides:

Section 6. Planting. "The Mayor and Aldermen, Selectmen, Road Commissioners, or any municipal officer of a city or town to whom the care of the streets or roads may be entrusted, may authorize the planting of shade trees therein wherever it will not interfere with the public travel or with private rights; and shade trees standing and trees planted pursuant to such license shall be deemed and taken to be the private property of the persons so planting them, or upon whose premises they stand, or are planted."

Section 7. Penalty. "Whoever wantonly injures, defaces, tears or destroys an ornamental or shade tree, shrub, statue fountain, vase, or other plant or fixture of ornament or utility on a street, road, square, court, park, public garden, or other enclosure, shall forfeit not less than five, nor more than one hundred dollars, to be recovered by complaint, one-half to the complainant, and the other half to the use of the person on whose property or within whose premises the trespass was committed."

Section 9. "In a city in which the City Council, and in a town in which the inhabitants accept this section, or have accepted the corresponding provisions of earlier statutes, the Mayor and Aldermen or Selectmen may set out and maintain shade trees upon the public squares and highways at the expense of such city or town, which may appropriate annually for that purpose a sum not exceeding twenty-five cents for each of its rateable polls in the year next preceding that in which such appropriation is made."

Section 10. Trees not to be cut down, etc. "No person shall cut down or remove an ornamental or shade tree standing in a highway, town way, or street, without first giving notice of his intention to one of the Selectmen or Road Commissioners, or to the Mayor:—And if the Selectmen or Road Commissioners, or Mayor and Aldermen desire to retain the tree, they shall give notice of such desire to such person within ten days thereafter; and the damage caused by retaining said tree shall be determined in the same manner as in the case of damage by an alteration in such highway, town way, or street."

Section 11. "If a person cuts down, removes or injures such tree, in violation of the provisions of the preceding section, or of the rights of a city or town acquired thereunder, he shall suffer the penalty provided in section seven, and the same shall accrue to the city or town."

Resolve of Chapter 32 of 1886:

Arbor Day. "*Resolved*, That His Excellency, the Governor, is requested to set apart in each year the last Saturday in April as Arbor day, and to issue his proclamation recommending that it be observed by the ..... people of the Commonwealth in the planting of trees, shrubs and vines, in the promotion of forest growth, and culture in the adornment of public and private grounds, places and ways, and in such other efforts and undertakings as shall be in harmony with the general character of a day so established."

And this is now in effect and working good. So it appears that the framers of our public laws recognized that the æsthetic as well as the useful and protective and profitable had claim to their attention, for it is to be observed, and it is meaningful, that they included ornamental with shade trees: and therefore

it has been admitted that the preservation of the beautiful is of public interest and benefit, and by affixing a penalty, it is declared, and by subsequent action in the courts, it is determined that the destruction of the beautiful, in this regard at least, is a crime, for penalties only follow offenses. Damages may be recovered by suit for trespasses and private torts, but penalties are only imposed upon public offense.

But the law-makers have gone further. Urged by many persons who deplored the rapid thinning out, by decay or design, or through corelessness, of our wayside trees, the Legislature of 1890, provided as follows:

Section 1. 1890, Chap. 196. and Chap. 49 of 1891.

"The Mayor and Aldermen of the cities and the Selectmen of the towns within the Commonwealth, are hereby authorized to designate and preserve, as hereinafter provided in this act, trees within the limits of the highways for the purpose of ornament and shade (observe the aesthetic *ornament*), and to so designate not less than one such tree in every 33 feet where such trees are growing and are of a diameter of one inch or more."

Chap. 196. Sec. 2. Marking Trees.

"Said Mayor and Aldermen and Selectmen shall, between the first day of September and the 31st day of December in each year, designate such trees as are selected by them for the purposes set forth in this act, by driving into the same, at a point not less than four nor more than six feet from the ground and on the side toward the center of the highway, a nail or spike with a head with the letter M plainly impressed upon it. Such nails and spikes to be procured and furnished by the Secretary of the Commonwealth (now by amendment, 1891, Chap. 49, 'the Secretary of the Board of Agriculture') to said Mayor and Aldermen and Selectmen as required by them for the purposes of this act."

Renew Mark.

"Said Mayor and Aldermen and Selectmen, between the first day of September and the 31st day of December of each succeeding year, shall renew such of said nails and spikes as shall have been destroyed or defaced, and shall also designate in the same manner as hereinbefore stated such other trees as in their judgment should be so designated to carry out the requirements of this act."

Chap. 196, Sec. 3.

"Whoever wantonly injures, defaces or destroys any tree thus designated, or any of such nails or spikes affixed to such trees, shall forfeit not less than five dollars, nor more than one hundred dollars, to be recovered by complaint, one-half to the complainant, one-half to the use of the town wherein the offense was committed."

Chap. 196. Sec. 4.

"This act shall not apply to ornamental or shade trees whose preservation is now provided for by Chap. 54 of Public Statutes and acts amendatory thereof."

And to provide for carrying out this act, in 1891 the Legislature passed Resolve, Chap. 72, as follows:

Appropriation.

"*Resolved*, That there be allowed and paid out of the Commonwealth a sum not exceeding one hundred dollars, for the purpose of furnishing nails or spikes, as provided for in Chap. 49 of Acts of 1891, entitled 'An Act Relating to Preserving Ornamental and Shade Trees on the Highways.' Said nails or spikes to be procured and furnished by the Secretary of the State Board of Agriculture."

In 1892, by Chapter 147, it was provided:

Enlarging time for marking.

"The officials charged with the duty of marking ornamental and shade trees for their preservation within the limits of highways, under the provisions of Chapter 196 of the Acts of 1890, may make and renew such marks at such seasons of the year as they deem proper."

In order to protect the roadside trees, Chapter 403 of Acts of 1893 was passed. It is as follows:

"Whoever affixes to any tree in a highway, public way or square, a play-bill, poster, notice, advertisement, or printed paper of any description, or cuts, paints, or marks on such tree, without first obtaining a written permit from the officer having the charge of such trees in a city or from the Selectmen in a town, shall be punished by fine not exceeding fifty dollars and not less than five dollars for each offence."

Now, there is probably no one present who cannot aid in the carrying out the purposes of these acts to a complete accomplishment of their beneficence. It is probable that each person here can influence the officers in the government of his city or town or village, to diligence in enforcing these laws, and alacrity in availing themselves of their provisions. Every one of us can arouse enthusiasm and energy that shall beget action in some other one or more of our fellow-townsmen, and through them our whole community.

Let us each consider him or herself a committee of one to "see to" this matter. Let us persist and insist by entreaties, by argument, with prayers, if necessary, and *swears*, if unaccomplishable otherwise, and labor with, and belabor if need be, all our Mayors, our Aldermen, our Selectmen, our Road Commissioners, our neighbors—everybody who can help to take hold of this matter and see to it.

The air is burdened by unsyllabled Amens! But amens, though good as encouragers, are not efficient. Action will be.

But there is a step in further advance to be taken. And some of us can perhaps set an example as well as present an argument in favor of that step.

The statute and laws which have been quoted are well enough as far as they go, but they do not go far enough. Nor can they. For they cannot invade personal rights, unless by the exercise of the right of eminent domain more largely than would seem advisable, perhaps.

They cannot provide that whenever a forest owner along a highway changes his woodland to arable or pasture land he shall leave a proper reasonable belt of trees alongside the roadway, *upon his own land,* so that the road may not be deprived of shade and the wayside view of beauty; but we can do it with our own, if we are woodland roadside owners, and our neighbors who are such owners may be persuaded to do it.

To effect this, after or with the enforcement of the quoted acts, is the duty of the day. Let us all address ourselves to it, and, with others or alone, circumtramp our woodland ways, and, finding out where work may be needed and action taken, direct the attention of the improvement societies of our towns or villages to the subject and object, and arouse such feeling and create such a public opinion, by meetings or otherwise, as will convince the wayside woodland owner that he can be a public benefactor, and at the same time benefit himself by sparing the shade or ornamental trees along his front, to fringe with beauty the road that would otherwise be a weary way.

It will not be a hard task to effect this. Many land owners now adopt the practice of so fringing roadways; it should be universal; and we can almost assert that in many cases where the contrary has been done, it has been through thoughtlessness.

The beauty, the utility and the future profit of such a plan seem so plain to be seen and expected, that one could hardly fear failure in advocating it. But there is no time to lose. Every day there is danger that damage may be done that half a century will not repair. If every man and woman here present will give a little time and energy to this beneficent object, it will be accomplished. The man who plants a tree in a proper place is a benefactor prospectively. He who leaves one in its natural, proper place, is a benefactor instantly.

INDEX TO TITLES AND AUTHORS.

PAGE.

Adirondack Forest: Verplank Colvin 142
Andrews, Gen. C. C.: Prevention of Forest Fires . . 179
Barrett, W. W.: North Dakota 103
Berthoud, Edward L.: In Pathless Wood 164
Bessey, Charles E.: Notes on the Sand Hills and Pine Forests of Nebraska 83
Bliss, Henry C.: Street Planting and Shade Trees . . 187
Bush B. F.: Missouri 81
Colby, Prof. James F.: The Forestry Legislation of New Hampshire 147
Colvin, Verplank: Adirondack Forest 142
Conservation of Soil and Water Supply of Hill Countries in Cultivated Areas, T. J. McKie, M. D. 137
Constitution and By-Laws 21
Co-Operative Forestry. George B. James 169
Destruction and Repair of Our Natural Resources. John F. Lacey, M. C. 55
Dubois, Senator Fred. T.: The Need of a Forest Policy for the Western States 47
Economies in Railway Ties. E. E. Russell Tratman . 182
Eliot, Charles: Notes on the New Public Forests near Boston 114
Forest Fungi, Anthracnos of Poplars. Dr. B. D. Halsted 176
Forestry Legislation of New Hampshire. Prof. James F. Colby 147
Gifford, John: New Jersey 93
Halsted, Dr. B. D.: Forest Fungi—Anthracnose of Poplars 176
Hammond, E. W.: Forestry Conditions in Oregon . . 103

PAGE.

Harrison, J. B.: Public Misapprehension of the Forestry Question 158
Higley, Warren Progress of Forestry Legislation in New York 99
Hobbs, John E.: The Location of the Principal Forests of Maine, the Condition of Forestry and the Forestry Movement 79
Hopkins, Prof. A. D.: The Relations of Insects and Birds to Present Forest Conditions 173
Hopkins, Prof. A. D.: West Virginia 110
In Pathless Wood. Edward L. Berthoud 164
James, George B.: Co-operative Forestry 169
Jones, W. Goodrich: Texas 108
King, Prof. F. H.: Observations on the Destructive Effects of Winds and the Protection Afforded by Woodlands and Windbreaks 125
Kinney, Abbot: California 68
Lacey, John F., M. C.: The Destruction and Repair of Our Natural Resources 55
Legislation Favoring the Planting and Protection of Roadside Trees in Massachusetts. Wm. S. Shurtleff. 192
McKie, Thos. J., M. D.: The Conservation of Soil and Water Supply of Hill Countries in Cultivated Areas . 137
McLouth, L.: South Dakota 107
McRae, Thomas C., M. C.: National Forestry Legislation, 62
Members, List of 5
Mohr, Dr. Charles: Alabama 66
Morton, Hon. J. Sterling: Remarks at Joint Meeting Am. For. Assoc. and Nat'l Geogr. Soc., 1896, ... 45
Moses, G. H.: Forest Conditions and Forestry Problems in New Hampshire 89
National Forestry Legislation. Thomas C. McRae, M. C. 62
Need of a Forest Policy for the Western States. Senator Fred. T. Dubois 47
Notes on the New Public Forests Near Boston. Charles Eliot 114
Observations on the Destructive Effects of Winds and the Protection Afforded by Woodlands and Windbreaks. Prof. F. H. King 125

PAGE.

Officers for 1896 3
Pammel, Prof. L. H.: Iowa 77
Parsons, Geo. H.: Colorado 74
Prevention of Forest Fires. Gen. C. C. Andrews . . 179
Proceedings, Special Meetings, Brooklyn, New York, and White Mountains, 1894 23
Thirteenth Annual Meeting, 1894, ... 27
Special Meeting, Springfield, Mass., 1895, ... 30
Fourteenth Annual Meeting, 1896 38
Proctor, Hon. Redfield: Vermont 100
Public Misapprehension of the Forestry Question. J. B. Harrison 158
Publications of the American Forestry Association . . 2
Putnam, H. C.: Wisconsin 112
Relations of Insects and Birds to Present Forest Conditions. Prof. A. D. Hopkins 173
Rothrock, Dr. J. T.: The Forestry Cause in Pennsylvania 105
Shurtleff, Wm. S.: Legislation Favoring the Planting and Protection of Roadside Trees in Massachusetts . . 192
Street Planting and Shade Trees. Henry C. Bliss . . 187
Tratman, E. E. Russell: Economies in Railway Ties . . 182
Troop, Prof. J.: Indiana 76
Vermeule, C. C.: Woodlands and Waterflow in New Jersey 130
Woodlands and Waterflow in New Jersey. C. C. Vermeule 130

SD
118
A47
v.11
no.3

American Forestry Congress
Proceedings

[redacted]

Biological
& Medical
Serials

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

LIBRARY
[redacted]
UNIVERSITY OF TORONTO